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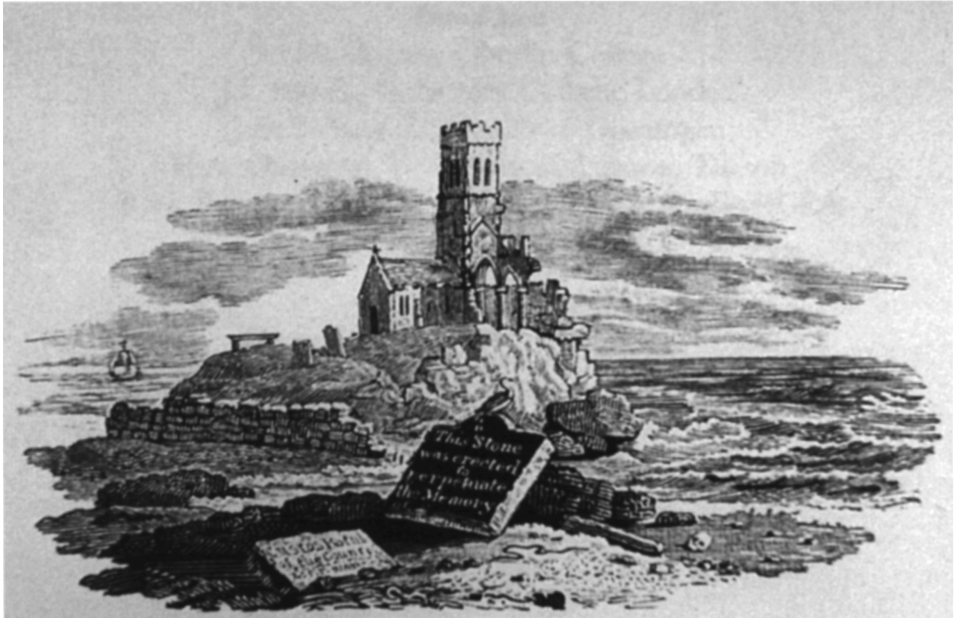
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VOLUME 80





Tailpiece from *History of British Birds* (1804) by Thomas Bewick, described by Charles Lyell in *Principles of Geology*.

GEOLOGY AND RELIGIOUS SENTIMENT

*The Effect of Geological Discoveries on English Society
and Literature between 1829 and 1859*

BY

J.M.I. KLAVER



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LIST OF ABBREVIATIONS

LLL: K. Lyell, *Life, Letters and Journals of Sir Charles Lyell*

LLS: J.W. Clark and T.M. Hughes, *The Life and Letters of the Reverend Adam Sedgwick*

LLW: I.Todhunter, *William Whewell: An Account of his Writings with Selections from his Literary and Scientific Correspondence*

INTRODUCTION

"If only the Geologists would let me alone, I could do very well, but those dreadful hammers! I hear the clink of them at the end of every cadence of the Bible verses." Thus John Ruskin lamented in 1851 the state of his religious faith, which had been profoundly affected by the discoveries of the geologists. Ruskin's exclamation expresses both a melancholy regret for the loss of the authority of the Bible and an unwillingness to discard scientific truth. Like so many Victorians (including the professional geologists) he tried to come to terms with the way geology seemed to cry out for a new world view. Although the gap between science and revelation was often minimized, professionals and laymen alike realized that reconciliation was becoming more difficult with every new discovery. Many of the more open-minded Victorians could admit that the Bible was not literal truth, but the effect of the geological discoveries seemed to move man ever further from the centre of the creation; they made his role look insignificantly small in the history of the earth. Many early Victorians shared a feeling that somehow the dignity of man was at stake. Ruskin heard this in the geologists' hammering away at the Biblical account of the creation.

A century after Ruskin's expression of his religious distress, Charles Coulston Gillispie published in *Genesis and Geology* (1951) the first detailed study of the tension between pre-Darwinian geology and Mosaic orthodoxy. Early nineteenth-century geology has enjoyed the interest of historians of science ever since, and much attention has been paid to the pre-Darwinian uniformitarianist-catastrophist debate. In geology the uniformitarian tries to explain the former changes of the earth's surface by forces not differing in kind and intensity from the ones now in operation, while the catastrophist holds that the surface of the earth bears traces of a series of paroxysmal changes which can only be explained by great revolutions of a kind and energy different from present causes of change. As the uniformitarianism of the nineteenth-century geologist Charles Lyell is usually seen as the basis of modern geology, he has had a large share of the attention of the historians. Michael Bartholomew has even labelled it the 'Lyell industry'.¹ An important place has been taken by Leonard G. Wilson's research for a Lyell biography, the first part of which was published in 1972.² His work led to the discovery of a series of revealing scientific journals written by Lyell during the years just before the publication

¹ "The Singularity of Lyell," p. 276.

² *Charles Lyell; The Years to 1841: The Revolution in Geology* (1972).

of *The Origin of Species* which showed Lyell's religious reluctance to accept evolution.³

Gillispie's book is generally acknowledged as an important pioneer study, but its reputation fell when a later school of historians, having reconsidered Lyell's place in the history of geology, pointed out that Gillispie had paid excessive attention to the two conflicting theories in geology and, inspired by the post-Darwinian debate, described with inappropriate gusto an intellectual battle that never took place. Even Wilson's Lyell biography was criticized for such an approach when he presented Lyell as the defender of uniformitarianism, the arch-enemy of the Catastrophist school, the man who in retrospect introduced the theoretical principles of modern geology, while other geologists, like Adam Sedgwick and William Buckland, were seen as blind defenders of an orthodox non-scientific interpretation.

In the 1970s historians increasingly doubted such a dichotomy between uniformitarianism and catastrophism. Especially W. Faye Cannon, Martin Rudwick and Roy Porter studied the strategy of Lyell's *Principles of Geology* and pointed to his Whiggish interpretation of history, an interpretation in which Lyell marshalled the men who had contributed to the progress of geology and condemned and ridiculed those who had obstructed it. The approach was clearly based on Lyell's selective representation of the past, which could not but culminate in his interpretation of the phenomena of nature in uniformitarian terms. Late nineteenth-century historians, such as Archibald Geikie in his *Founders of Geology* (1897), had swallowed Lyell's view of history without hesitation and were directly responsible for early twentieth-century textbook interpretations.⁴

Once aware of this strategy, historians realized that Lyell himself was to a great extent responsible for a distortion of history and had written the history of geology and his own place in it for future generations. Part of the Lyellian myth was thus unmasked. Lyell's opponents were shown to have a good conception of earth history as well as a more than adequate understanding of scientific methodology and were not by any means simply blind dogmatists. R. Hooykaas's excellent study *The Principle of Uniformity* (1963) contributed much to the rehabilitation of Lyell's contemporaries.

Important though these studies are for the scientific presuppositions of early nineteenth-century scientists, most historical accounts still lose sight of a battle which the orthodox geologists, more than Lyell, fought to free the science from Moses. In this all professional geologists, whether labelled uniformitarian or catastrophist, were very much on the same side.

At the same time another more insistent part of the myth still exists in textbooks, both of geology and of history. Lyell is persistently seen as Darwin's

³ Sir Charles Lyell's *Scientific Journals on the Species Question*, ed. Wilson (1970).

⁴ Cf. Ospovat, "The Distortion of Werner in Lyell's *Principles of Geology*," pp.194-96.

forerunner and *Principles of Geology* finds a place beside *The Origin of Species*. Lyell is credited with the discovery of past time necessary for the discovery of evolution, and he is often described as the man who made evolution possible and who supported Darwin's theory when it was hotly debated in the 1860s. Although Lyell's reservations about evolution are recorded in passing, usually with a reference to the fact that Lyell remained a member of the Anglican Church till the end of his life, he is still seen as one of Darwin's champions who stood diametrically against the more orthodox reactions of men like Adam Sedgwick and William Whewell. It is in such an approach that Lyell is still seen as Darwin's immediate forerunner. No doubt Darwin's acknowledgement of the influence of Lyell's thinking contributed to this view, but admissions from Lyell himself remain vague and reluctant.

The problem of why Lyell had difficulty in accepting evolution, especially as so much of his writing seemed in retrospect to tend in that direction, has also occupied various historians of science. Cannon has maintained that the explanation of Lyell's insistence on non-progression lay in Lyell's professional reasons rather than in his personal psychology.⁵ He does not discuss any religious influences on Lyell's thinking. Bartholomew has argued for the opposite case and showed that Lyell feared evolutionary ideas in part because they contradicted, and were not derived from, Christian theology.⁶ This is the approach which I have adopted in this study, as it takes into account more than mere scientific attitudes.

In delineating the confines of the history of an idea in his classic *The Great Chain of Being* A.O. Lovejoy stressed that

any unit-idea which the historian thus isolates he next seeks to trace through more than one—ultimately, indeed, through all—of the provinces of history in which it figures in any important degree, whether those provinces are called philosophy, science, literature, art, religion, or politics. The postulate of such a study is that the working of a given conception, of an explicit or tacit presupposition, of a type of mental habit, or a specific thesis or argument, needs, if its nature and its historic rôle are to be fully understood, to be traced connectedly through all the phases of man's reflective life in which those workings manifest themselves, or through as many of them as the historian's resources permit. It is inspired by the belief there *is* a great deal more that is common to more than one of these provinces than is usually recognized.⁷

It seems to me that much recent research still suffers from a lack of such an awareness.⁸

*

⁵ "Charles Lyell, Radical Actualism, and Theory" (1976).

⁶ "Lyell and Evolution" (1973).

⁷ *The Great Chain of Being*, p.15.

⁸ Nicolaas Rupke's study of William Buckland, *The Great Chain of History* (1983), is a refreshing exception to this tendency.

What I have wanted to highlight at the beginning of this study is, on the one hand, the interaction between Lyell's scientific work and his own religious sentiments, and, on the other hand, the religious debate with other geologists. Many of Lyell's comments and reactions belie his supposedly revolutionary place in his time. His writing was not anti-religious and his religious sentiments were not essentially different from those of his contemporary colleagues who were more often than not church dignitaries as well. Nor did his opponents see a divergence between Lyell's religious ideas and their own. Because Sedgwick and Whewell reviewed Lyell's *Principles of Geology* in the press and did not agree with uniformitarian principles, they have frequently been seen as Lyell's critics and opponents, while what they share in outlook with Lyell is ignored. It is often forgotten, for example, that both Sedgwick and Whewell deeply admired Lyell's work. Whewell's views on geology in his *History and Philosophy of the Inductive Sciences* derived very much from Lyell's *Principles of Geology*.

My aim has been to give a picture of the time by discussing the religious and scientific suppositions of three prominent geologists of the period (Lyell, Buckland, Sedgwick) and a philosopher of science (Whewell). Much space has been given to their individual reactions and their use of the idea of natural theology as a basic working method in geology. I conclude with a study of the reaction to geology in the non-professional public.

My approach to Lyell's scientific ideas has been based on biographical material indicating his imaginative powers and his religious state of mind during the decades preceding Darwinism. Emphasis has been laid on a proper interpretation of Lyell's impatience with the interference of religion in science. By comparing it to similar sentiments in Sedgwick's writings I have wanted to show that such feelings were not anti-religious in nature. Lyell's disgust with the geologist George Hoggart Toulmin, whose central ideas were not essentially different from Lyell's, deserves more attention than it has received hitherto. It is an example which shows that already early in his career Lyell was by no means willing to controvert the orthodoxy of the day, but ultimately saw his work in the light of natural theology. Lyell's interest in questions of religious doctrine has also been underrated by historians, and his predilection for Unitarianism has been ignored.

In my chapters on Buckland, Sedgwick and Whewell I have tried to complete the picture drawn of Lyell in the first part of the book. Although in these chapters I concentrate principally on these scientists and study their reactions and ideas from their own point of view, they are constantly linked to Lyell's, thus showing that Lyell's position in geology was not as special as is often supposed. Different opinions in scientific method and theory are explained by their different interpretations of the logic of natural theology and their reliance on aprioristic reasoning in science and religion.

My approach to Buckland's views of the relationship between geology and religion differs to some extent from Rupke's fine study of this scientist. It seems to me that there is an apologetic tendency in Rupke's view of Buckland's Mosaic geology which obscures his sincere belief in the principles of natural theology. Buckland's *Bridgewater Treatise* of 1836 makes this clear: his fellow-geologists took the natural theology there seriously enough. His natural theology, therefore, features centrally in my chapter, as it is in such a context that *Geology and Mineralogy* was impatiently awaited by his colleagues, harshly criticized by men of the cloth, and eagerly read by the general reading public.

Sedgwick and Whewell have only recently been the subject of study, and much emphasis falls on their contributions to the progress of science. In my chapters on these two clergymen-scientists I have tried to trace their geological careers in relationship with their religious activities, again paying attention to the idea of natural theology that underlay so much of their work. It turns out that Buckland and Sedgwick, rather than Lyell, had the hardest fight with the Mosaic dogmatists

Although excellent studies exist on the influence of evolution (including pre-Darwinian evolution) on literature and public opinion,⁹ very little has been written about the influence of geology. Apart from occasional references to the repercussions of geology in literature, no systematic study has been undertaken. Milton Millhauser is useful for the influence of *Vestiges of Creation*; Susan Gliserman and Isobel Armstrong are the culmination of a long tradition of Tennyson scholarship on the influence of geology on *In Memoriam*, but remain startlingly lacking in direct comparisons of the works of the geologists with Tennyson's text.¹⁰ Dennis R. Dean in a more general approach,¹¹ presenting a respectable number of examples in Victorian texts, unfortunately remains inadequate: as a mere list of geology in Victorian literature it is often sweeping in its conclusions and makes too much of references to geological phenomena which feature only marginally in the literary works discussed. To say that a description of a landscape resembles a geological map or that the volcanic eruption in a novel set in Roman times is inspired by the early nineteenth-century vogue for geology is begging the question.

In the third part of my study I have tried to connect references to geology in literature with the religious sentiments of the characters or their authors. To avoid the contamination of Darwinism, references in works published after *The Origin of Species* (1859) have been excluded unless explicit

⁹ E.g. Roppen, *Evolution and Poetic Belief* (1956); Burrow, *Evolution and Society* (1966); Beer, *Darwin's Plots* (1983); Levine, *Darwin and the Novelists* (1988).

¹⁰ Gliserman, "Early Victorian Science Writers and Tennyson's *In Memoriam*: A Study in Cultural Exchange" (1974-75); Armstrong, "Tennyson in the 1850s: From Geology to Pathology - *In Memoriam* (1850) to *Maud* (1855)" (1992).

¹¹ "Through Science to Despair: 'Geology and the Victorians'" (1981).

reference is made to pre-Darwinian geology. Thus the use of George Eliot's notions of earth history in her novels published after *Adam Bede* (1859) and *The Mill on the Floss* (1860) have been omitted, as it would be impossible to separate them from the influence of *The Origin of Species*. Similarly, my discussion of Tennyson and Robert Browning rigorously stops on the eve of the publication of *The Origin of Species*. On the other hand, Winwood Reade's *The Outcast* (1875), Butler's *The Way of All Flesh* (1903), and Gissing's *Born in Exile* (1892) present reflections on geology that clearly go back to the decades before Darwin's epoch-making book.

Although the influence of geology on the public initially seems minimal, different attitudes have been found in those writers who concentrated on geological discovery. Impressed by Tennyson's struggles with science, historians of literature have usually seen geology as threatening the traditional values of society. My study, however, shows that most early-Victorian religious novels are not affected at all by the problems raised by geology, while a number of writers actually find in this science a power which will lead man to a more human view of his place in creation.

CHAPTER ONE

THE GEOLOGICAL SETTING: THE DANGEROUS AND VISIONARY PURSUIT

Geology proper was a relatively recent science in the early nineteenth century, emerging slowly as a distinct field of study out of the collective eighteenth-century denomination Natural Philosophy. Like other branches of Natural Philosophy, geological investigation was initially a search for facts which proved the creation in terms of the Mosaic account in Genesis. Although some important discoveries were made in the field, most eighteenth-century studies in geology remain rather fanciful efforts at cosmogony, aprioristic reasoning, rather than pure inductive science.

Natural Philosophy was a popular and gentlemanly pastime, pursued both for its outdoor amusement and for its edifying religious qualities. It was, moreover, not without social prestige. In the perfection of nature's holy plan, man could find evidence of God's hand, and this explains why the clergy were often so eminently engaged in natural studies. They had the time, the means and the incentive. Moreover, late eighteenth-century utilitarianism combined with religion in a new impulse to study nature as expressly created for man. This approach is manifest in William Paley's *Natural Theology* (1802), the culmination of an interest in nature as proof of the perfection of the Creator's plan. Its fame lasted till far into the nineteenth century and it remained a set-text for students of theology and medicine, as well as a justification for busy clergymen-naturalists.¹ About its leading idea—design—Paley writes that

there cannot be design without a designer; contrivance, without a contriver; order without choice; arrangement, without anything capable of arranging; subserviency and relation to a purpose, without that which could intend a purpose.²

Without dismissing scriptural revelation, Paley argues that natural revelation of design is unequivocal and in itself sufficient to prove God's existence and his constant superintendence. Paley's God is fully present in natural revelation. He ingenuously analyses the different anatomical parts of plants and animals to glorify the immense insight and benevolence of the Creator. Where direct purpose or use is lacking, he argues for a principle of beauty which is part of the design, part of a final cause: "Is it not more probable, that this property,

¹ For the role of Paley in the Cambridge curriculum see Garland, *Cambridge before Darwin*, pp.57-58.

² *Natural Theology*, pp.7-8.

which is independent, as it should seem, of the wants and utilities of the plant, was calculated for beauty, intended for display?"³ Our conception of nature's beauty in turn "may be regarded as a proof of the benevolence and design, that the Author of nature has constituted our senses and faculties to receive such delightful impressions from the inanimate objects with which we are surrounded."⁴

Paley's contemporary Richard Kirwan, the eminent geologist of Dublin, is a good example of the principle of natural theology applied to geology. Kirwan emphasizes that it is one of the main purposes of this science to discuss the origin of the earth because only thus can design be made clear. He actually sees it as a way to fight infidelity:

Recent experience has shown that the obscurity in which the philosophical knowledge of this state has hitherto been involved, has proved too favourable to the structure of various systems of atheism or infidelity, as these have been in their turn to turbulence and immorality, not to endeavour to dispel it by all the lights which modern geological researches have struck out.⁵

It is not to be supposed that, because Paley and Kirwan are essentially eighteenth-century in outlook, natural theology did not reach far into the nineteenth century. Notwithstanding a growing incentive to inductive investigation and reasoning, studies which are typically part of the school of natural theology continue to be published—and some of them of great fame.⁶ The Bridgewater Treatises of the 1830s, for example, are eight studies in natural science showing "the Power, Wisdom, and Goodness of God, as manifested in the Creation."⁷ The series included a work on geology written by the Oxford professor of geology, the Rev. William Buckland, which was published in 1836.

Natural theology is often seen in antithesis to evolution, but the publication of Charles Darwin's *Origin of Species* in 1859 by no means made it an obsolete approach to the study of the phenomena of nature. Witness, for example, the following telling extract from *Footnotes From the Page of Nature*, a popular work on the simplest forms of vegetable life published in 1861 by Hugh

³ *Natural Theology*, p.132.

⁴ Bakewell, *An Introduction to Geology* (1813), p.96.

⁵ *Geological Essays*, p.3 (quoted by Gillispie in *Genesis and Geology*, p.50).

⁶ Brooke makes an interesting case that natural theology, apart from being an expression of religious sentiment, should mainly be seen as a "mediating function between different religious traditions," which was "an obvious way of pacifying as large an audience as possible" ("The Natural Theology of the Geologists", pp. 42,44). Although he does not suggest "that an emphasis on the agency of the Creator was a matter of expediency alone" (p.44), Brooke still seems to underestimate the incentive natural theology gave to the pursuit of science. His essay "Indications of a Creator: Whewell as Apologist and Priest" amply corrects that impression (see pp.149-150).

⁷ Thomas Chalmers, *On the Power, Wisdom, and Goodness of God as Manifested in the Adaptation of External Nature to the Moral and Intellectual Constitution of Man*, p. ix. [the first Bridgewater Treatise].

Macmillan, a clergyman who espoused Paley's theory of natural theology when he asserts that nature

is at once utilitarian and transcendental. Uses and beauties intermingle [...] All things proclaim that the Divine Architect, while amply providing for the physical wants of his creatures, has not forgotten their spiritual necessities and enjoyments [...] and one of the most striking examples of this Divine care is to be seen in the profusion of minute objects spread around us [...] subserving no gross utilitarian purpose [which] are intended to educate man's spiritual faculties by the beauty of form [...] Their beauty is sufficient reason for their existence were there no other [...] We are brought face to face with perfection [...] with objects which bear most deeply impressed upon them the signet-mark of their Maker; and we observe with speechless admiration that the Divine attention is acuminated and His skill concentrated on these vital atoms.⁸

But even as late as 1872 can we read the Rev. Charles Kingsley, as a popularizer of geology, advocating the study of geology as the "vox Dei in rebus revelata."⁹

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At the beginning of the Industrial Era, man showed an increasing interest in minerals and their uses. The experience of quarrying and mining gave a new impulse to study the earth's crust. As industry needed raw materials such as coal and ores, building materials, as well as fast and efficient possibilities of transport, a thorough knowledge of strata was of great help. Richard Kirwan, for example, opens a technical paper on stony substances presented to the Royal Irish Academy in 1793 with the following statement: "The origin of stony substances, seemingly an object of mere curiosity, is nevertheless connected with desiderata of the greatest utility to mankind."¹⁰ Geology thus served industry directly, and, as a consequence, this again helped along geological investigation. Mines, quarries, and construction sites of canals and roads did not only show stratigraphical structures, but also brought many new fossil remains to light, which were all new pieces of the puzzle of the earth's past. Geology, although still an "infant science," develops at an enormous rate during this period.¹¹

Thus we see a mixed approach to geology at the beginning of the nineteenth century, which was at the same time admiration for God's creation among the religious and of service to the utilitarian. This combination of divine design and utilitarianism is neatly expressed by the early nineteenth-century geologist

⁸ *Footnotes From the Page of Nature*, pp.12-14.

⁹ *Town Geology*, p.xx.

¹⁰ "Examination of the Supposed Igneous Origin of Stony Substances", *Transactions of the Royal Irish Academy*, pp.51-81.

¹¹ See Porter, *The Making of Geology: Earth Science in Britain, 1660-1815*.

Robert Bakewell in the opening paragraphs of *An Introduction to Geology*: “In tracing the progress of knowledge, we may frequently observe that the cultivation of particular branches of science at certain periods was determined by causes which had little connection with their intrinsic utility.” But although “the value of every science must ultimately rest on its utility [...it also] stimulate[s] our intellectual powers to the discovery of [...] the contrivance of the Divine Artist.”¹² William Smith in England and Abraham Gottlob Werner in Germany are perfect products of this utilitarian school of geology.

The land-surveyor and civil engineer William Smith, who in isolation worked on stratigraphy during the first two decades of the century, became one of the leading geologists of Britain with his stratigraphical map of England and Wales, on which he started working in 1799 and finally published in 1815. Archibald Geikie in his *Founders of Geology* (1897) writes of William Smith that “in agriculture, in mining, in road-making, in draining, in the construction of canals, in questions of water-supply, and in many other affairs of everyday life, he was able to prove that his system of observation possessed great practical utility.”¹³

On the other side of the Channel, Werner swayed the geological wand. His father, an inspector of a Saxon foundry, inculcated an interest in minerals in him. When he was asked at the age of 25—he had already published an orderly classification of minerals in 1774—to become Inspector and Teacher of Mining and Mineralogy in the Freiburg Mining Academy, he turned mineralogy into one of the most popular subjects of his day. He would expound on the uses of minerals and their far-reaching influence on the development of industry, the progress of civilization, the migration of races or the spread of languages. As minerals all had their specific uses and a profound influence on life, he urged that the artist, politician, historian, physician, and warrior would benefit alike from studies in his subject.

Werner managed to capture the minds of many and was able to convey the enthusiasm with which he studied mineralogy himself. Charles Lyell writes in 1830 in *Principles of Geology* of the rare qualities of this teacher as follows:

Werner’s mind was at once imaginative and richly stored with miscellaneous knowledge. He associated everything with his favourite science, and in his excursive lectures he pointed out all the economical uses of minerals, and their application to medicine; the influence of the mineral composition of rocks upon the soil, and of the soil upon the resources, wealth, and civilization of man [...] The charm of his manners and his eloquence kindled enthusiasm in the minds of his pupils, many of whom only intended at first to acquire a slight knowledge of mineralogy; but, when they had once heard him, they devoted themselves to it as the business of their lives.¹⁴

¹² *An Introduction to Geology*, pp.iii,xx.

¹³ *The Founders of Geology*, p.229.

¹⁴ *Principles*, i.55-6; see also Geikie, pp.108-9.

Students from all over Europe came to his university in Freiberg to attend his courses, and returned enthusiastically to their own countries to found Wernerian schools of geology, or geognosy, as they themselves called it. Robert Jameson, Regius Professor of Natural History at Edinburgh University, set up his Wernerian Natural History Society in 1808. Werner's popularity contributed to turning his ideas into something of a cult. Lyell comments, not quite objectively, that "they were blinded by their veneration for the great teacher, they were impatient of opposition, and soon imbibed the spirit of a faction."¹⁵

Werner held that all primary formations of the earth's crust were the results of a retreating sea, a sea which had covered the earth completely. His theory was attractive to religious conservatists and most serious geologists were willing to overlook some of its shortcomings. Werner's universal sea explained why fossils of salt-water animals were found at high altitudes¹⁶ and thus supported the biblical account in Genesis 1:9: "Let the waters under the heaven be gathered together unto one place, and let the dry *land* appear." The Neptunists did not trouble themselves with the staggering amount of water needed to cover the highest mountain peaks, or with the problem of where the waters retreated.

*

More than any other science, geology was bound to create tension with regard to religiously accepted truths in the long run, as its new discoveries inevitably tended to shed light on the age and origin of the earth, on "a state of things so different from what we now observe, and implying such long periods of past duration, [that] we find it difficult to admit, notwithstanding the numerous proofs by which it is supported," Bakewell writes in 1813.¹⁷ Geological discovery, therefore, was not always reassuring to the orthodox. Fossils seemed silent testimonies of mass extinction. Proof of a universal deluge seemed increasingly incomplete. And time itself seemed to burst out of its Mosaic confines. Orthodox geologists often had to force new discoveries into a religious context which was becoming more and more untenable.

The Scotsman James Hutton presented his geological theories to a professional world which accepted Werner's Neptunism. He studied medicine in Edinburgh, Paris and Leyden, but decided on a career as a gentleman farmer in Berwickshire. Here he cultivated the taste for geology which he had picked

¹⁵ *Principles*, i.60.

¹⁶ The Mosaic deluge, however, was needed to account for many fossils of land animals, which were recognized as the remains of extinct animals. The flood, consequently, remained an important event in geological history.

¹⁷ *An Introduction to Geology*, p.325.

up during his various excursions in England and on the continent. His geological observations were presented to the Royal Society of Edinburgh in 1785 and published in book-form as *Theory of the Earth* (1795). Hard to read, it was made more accessible by his disciple and friend John Playfair in *Illustrations of the Huttonian Theory*, published in 1802. In studying the Scottish countryside, Hutton saw the present process of erosion as a key to the formation of strata. Eroded primary rock, sedimented and turned again into more or less solid rock, pointed to a series of changes of the earth's crust throughout its history. The often perpendicular and dislocated positions of strata, moreover, led him to the conclusion that the waters could not have subsided in the Wernerian sense to expose continents, but that they must have been elevated and disturbed at different periods by convulsions of the earth. He looked for causes in subterranean forces of heat, and insisted on the agency of volcanoes in forming the primary strata of the earth, a process, he argued, which was still going on in places. He saw no reason why these forces would not have acted in the past in the same way as they were acting in his time.

Richard Kirwan reacted against Hutton's views in a series of essays and papers. Kirwan found Hutton's geological evidence wholly inconclusive on inductive grounds. Such an approach belies Charles Lyell's opinion of the Wernerians' blind dogmatism: Kirwan, in fact, marshals a great amount of observation which leads to his conclusion that "in our present view of nature all appearances point out a watery solution [...] but they contradict the idea of an igneous solution." He admits that his aqueous system labours under difficulties but that "the only point to be considered is which of the two systems, the aqueous or the igneous, is, upon the whole, least exceptionable."¹⁸

Kirwan was more belligerent against the idea of infinite time which Hutton's concept of uniformity of geological phenomena implied. Although Hutton chose the title *Theory of the Earth* for his treatise, it was in no way concerned with the origin of the earth. He acknowledged frankly that he could find "no vestige of a beginning—no prospect of an end."¹⁹ As his description of the endless cycle of uplift and erosion of land implied that the earth had to be infinitely older than was acceptable in biblical terms, his hypotheses provoked the resistance of natural theologians who severely criticized the immorality implicit in the abhorrent idea of infinite geological time:

[...] why should we suppose this habitable earth to arise from the ruins of another anterior to it, contrary to reason and the tenor of the mosaic history? What do we gain by that supposition? Must not the origin of that anterior world, if composed of materials similar to those of this, be equally accounted for? [...] or must we allow that anterior solid land to have been itself also formed of the

¹⁸ "Origin of Stony Substances" pp.71-77.

¹⁹ *Theory of the Earth*, (1788) p.304.

ruins of another still prior to it, and thus admit a process *in infinitum*; an abyss from which human reason recoils?²⁰

"I have been led into this detail by observing how fatal the suspicion of the high antiquity of the globe has been to the credit of the Mosaic history and consequently to religion and morality," Kirwan writes elsewhere.²¹ Hutton himself, however, ascribed his uniformitarianism to divine design. The unfavourable reception of his ideas might partly be imputed to the anxious attitude to all new theories in these revolutionary years. Charles Lyell, whose father had lived through these revolutionary years as a devoted student of nature, writes in 1830 as follows of the vulcanists:

The party feeling excited against the Huttonian doctrines, and the open disregard of candour and temper in the controversy, will hardly be credited by our readers, unless we recall to their recollection that the mind of the English public was at that time in a state of feverish excitement. A class of writers in France had been labouring industriously for many years, to diminish the influence of the clergy, by sapping the foundation of the Christian faith, and their success, and the consequences of the Revolution, had alarmed the most resolute minds.²²

The study of the history of the earth was closely linked to the study of historical chronology. Early in the Renaissance, scholars brought together their skills in, and knowledge of, classical languages and history to calculate the exact age of the earth. Mosaic chronology pointed to approximately 6,000 years. But the humanist Joseph Scaliger set historical chronology on a firm scholarly basis in his *De emendatione temporum* (1583) by basing his conclusions on a comparison of Mosaic chronology with other non-Christian chronologies. When he found, for example, that Chinese chronology started thousands of years before Mosaic chronology, biblical literalness was called in doubt. Isaac Lapeyrère, following Scaliger's premises 72 years later, stated in his *Preadamitae* (1655) that Mosaic history was only a fragment of true historical time and that he did not doubt "*primorum hominum creationem, a principio rerum longissime ante Adami revocare tempora.*" Orthodox defenders of the Mosaic account, however, maintained that non-Christian civilizations much exaggerated their antiquity. Gherard Vossius, for example, in his *Chronologiae sacrae* (1659) accused the Egyptians and other ancient civilizations of historical presumption, and his elder brother Isaac in the same year warned against the false chronologies which belonged to mythology rather than to true historical chronology.²³ Thus the orthodox apologist James Ussher ignored chronologies different from the Mosaic, and in *Annales veteris et novi*

²⁰ "Origin of Stony Substances" pp.63-64.

²¹ "On the primitive state of the globe and its subsequent catastrophe" (1797) p.307, quoted in Wilson, *Charles Lyell*, p.72.

²² *Principles*, i.65.

²³ See Rossi, *I segni del tempo*, pp.161-64, 191-92.

testamenti (1650-54) dated the creation from the Mosaic account at exactly 4004 BC. Ussher's research carried so much weight that the date was actually printed in the margin of the King James Bible in 1701, a decision which was criticized by Charles Lyell as late as 1850.

Evidence from nature played a marginal part in the dating of the creation. Mosaic historians of chronology would not doubt that the finds from nature were in conformity with the historical validity of the Bible. This view is reflected in Sir Thomas Browne's *Religio Medici*. Thus, for example, Browne maintains that the flood is a historical reality which is feasible to the human understanding when studied properly, although the emphasis he gives it shows that the topic was under discussion:

'Tis ridiculous to put off or drown the general Flood of Noah in that particular inundation of Deucalion. That there was a Deluge once, seems not to me so great a Miracle, as that there is not one always. How all the kinds of Creatures, not only in their bulks, but with a competency of food and sustenance, might be preserved in one Ark, and within the extent of three hundred Cubits, to a reason that rightly examines it, will appear feasible.²⁴

No perplexities about chronology can disturb the believer: "Time we may comprehend, 'tis but five days elder than our selves," Browne concludes briefly.²⁵ Biblical literalness and historical chronology, however, remained a vogue through the seventeenth and early eighteenth centuries.

Natural philosophers were increasingly confronted with the problems raised by fossils. John Ray (1627-1705), for example, was sincerely puzzled and was made to make a concession to the earth's age: "Whatever may be said for the Antiquity of the Earth itself and bodies lodged in it, the race of mankind is new."²⁶ But although he trusted much in his powers of reasoning and never let himself be blinded by Scripture, he did not doubt that complete knowledge would lead him to the right interpretation of Scriptural truth in the end.

Towards the middle of the eighteenth century, naturalists became more outspoken. In France, Benoit De Maillet in his *Telliamed* (1749) inclined towards a greater antiquity for the earth than Genesis warranted,²⁷ and Georges Louis Leclerc Buffon (1707-88) asserted that "nature's great workman is time;" although he calculated about 75,000 years in *Les époques de la nature* (1778), his unpublished manuscripts show that he probably had about three million years in mind.²⁸ Similar notions were promulgated in England by George Hoggart Toulmin, author of a popular and provocative treatise on the

²⁴ *Religio Medici* (1642-3), p.26.

²⁵ *Religio Medici*, p.12.

²⁶ Quoted in Eiseley, *Darwin's Century*, p.16.

²⁷ Ehrhard, *L'idée de nature en France dans la première moitié du XVIII siècle*, p.207; Rossi, *I segni del tempo*, pp.135-36..

²⁸ See Eiseley, *Darwin's Century*, p.44.

supposed eternity of the world. His *Antiquity and Duration of the World*, originally published in 1780, ran through various revised editions during the next fifty years.²⁹ Hutton made an increased time-span central to his theory of uniformity, and most early nineteenth-century geologists were willing to accept a much longer past for the earth than conventional historical chronology allowed. Thus in 1813 Bakewell does not deny the possibility of the countless ages needed for geological history while “both from natural appearances, from the Mosaic history, and from tradition, we may infer that the world is in a state of comparative infancy, if we commence our computation from the period when it became habitable by man.”³⁰

The idea that organic and inorganic material had existed on the earth millions of years before the creation of man rocked the Christian belief that God had created the world purposely for man. Man now seemed to come in merely as a kind of afterthought. An early reaction in literature is William Cowper’s comment on the geologist’s science in *The Task* (1783-4). He sees the discoveries about the past of the earth as a presumptuous “mad mistake”:

Some drill and bore
The solid earth, and from the strata there
Extract a register, by which we learn
That he who made it, and reveal’d its date
To Moses, was mistaken in its age.
[...] Full often, too,
Our wayward intellect, the more we learn
Of nature, overlooks her author more;
From instrumental causes proud to draw
Conclusions retrograde, and mad mistake.³¹

Cowper, who had had no scientific grounding, might have picked these ideas up from Toulmin’s book, a second edition of which came out in 1783, the very year Cowper was working on this section.

In the 1820s and 1830s geologists felt rather impatient with such criticism and were almost unanimous in claiming that much more time was needed to explain certain geological phenomena than the Mosaic account of the creation in the Pentateuch provided. Lyell, for example, writes in 1830 that “the amiable poet Cowper, [...] could hardly be expected to have inquired into the merits of doctrines in physics.”³² Genesis could no longer be taken literally when it unfolded the earth’s creation in six days. Those six days necessarily had to be taken figuratively as representing six periods. This did not disturb all

²⁹ Toulmin’s book ran through the following editions and reprints: *The Antiquity and Duration of the World* (1780, 1824), *The Antiquity of the World* (1783), *The Eternity of the World* (1785), *The Eternity of the Universe* (1789, 1825, 1837).

³⁰ *An Introduction to Geology*, p.327.

³¹ *The Task*, bk III (“The Garden”), 150-54, 235-39.

³² *Principles*, i.67.

the clergymen-geologists. Some triumphantly, but rather inappropriately, pointed to 2 Peter 3:8: “one day *is* with the Lord as a thousand years and a thousand years as one day.”³³ To others it was still possible that the present world was the world after the flood, which could probably be made to agree with the 6,000 years. Although this meant that geologists had to reckon with “former worlds” existing before the formation of the earth as they knew it,³⁴ it saved the credibility of Genesis when applied to our world. Evidence of man’s recent creation, moreover, which was no other than absence of fossil remains of man or his utensils in strata belonging to “former worlds,” reassured most thinkers that God did intervene in our world after all and that revelation tells of his introduction of man on earth.

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At the beginning of the nineteenth century, geologists were in favour of dissociating themselves from revolution and tended to amass material quietly instead. Charles Lyell records how the Geological Society of London at its foundation in 1807 decided to shun theoretical systems of the earth:

To multiply and record observations, and patiently to await the result at some future period, was the object proposed by them, and it was their favourite maxim that the time was not yet come for a general system of geology, but that all must be content for many years to be exclusively engaged in furnishing materials for future generalizations. By acting up to these principles with consistency, they in a few years disarmed all prejudice, and rescued the science from the imputation of being a dangerous, or at best a visionary pursuit.³⁵

Robert Bakewell’s *Introduction to Geology* is a good example of this new inductive approach to geology. Religious controversies seemed forgotten for a while, and geology could be studied in terms of natural theology again.

Thus the early years of the nineteenth century boast a great number of clergymen devoting themselves to the study of the earth, no doubt because, as William Buckland put it, “Geological knowledge, i.e. the knowledge of the rich ingredients with which God has stored the earth beforehand, when He created it for the then future use and comfort of man, must fill the mind of every one who acquires this knowledge, with feelings of the highest admiration, the deepest gratitude, and the most profound humility.”³⁶ Thus the Rev. Joseph Townsend published in 1813 *The Character of Moses Established for Veracity*

³³ See Gillispie, *Genesis and Geology*, p.56-66.

³⁴ “The present order of things, and the comparatively recent existence of man as the master of the globe, is as certain as the destruction of a former and different order,” Sir H. Davy, *Consolations in Travel*, dialogue 3, quoted by Lyell in *Principles* i.145.

³⁵ *Principles* i.71-2. See also Porter, *The Making of Geology*, p.2.

³⁶ Reply to the Presidential Address on receiving the Wollaston Medal in 1848, in Gordon, *The Life and Correspondence of William Buckland*, p.267.

as an *Historian, Recording Events from the Creation to the Deluge* and John Bird Sumner, later Archbishop of Canterbury, *A Treatise on the Records of the Creation* in 1816. Geological fact, however, seemed increasingly to controvert the Mosaic account of the history of the earth.

Although the late eighteenth-century terror of atheism had subsided, with the gradual advance of geological knowledge the question whether God was a mere First Cause who did not supervise life directly was increasingly disturbing religious minds. As a result the public was steadily fed with apologetic literature which tried to reconcile geology with revelation once more. Clergymen and laymen alike entered a debate which was to last until the early 1860s.

A number of clergymen could not ignore the necessity of a longer time-span for the earth any longer and accepted geological fact by pointing out the possible existence of geological eras between Genesis 1:1 and 1:2. Other men of the cloth clung to the literal sense of Genesis, which they thought they could reconcile with geological evidence.

Most of the geological-theological works of this period are popular rather than scientific, but some clerical names stand out, representing the ancient bulwarks of learning and religion: the Oxford Professor of Geology William Buckland, and Adam Sedgwick, Professor of Geology at Cambridge. Both occupied high posts in the Anglican Church. Sedgwick was probably the greater scientist, although Buckland, more than any other English clergyman, bestowed on geology much of its prestige in the eyes of the public. He linked geology firmly to religion in the publication of the sixth Bridgewater Treatise—*Geology and Mineralogy, Considered with Reference to Natural Theology*.

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When with the revival of religious sentiment in the 1830s the fire of controversy was kindled again (this time not among scientists, but between professional geologists on the one hand and amateur clergymen-geologists on the other), scientists felt increasingly impatient with religion and felt the need to free geology from Moses. This aggravated the situation.

The clash of geology with religion came in two separate phases. First it was questioned whether the Bible had to be taken literally or not. If it did not, then divine revelation was not truth. More seriously, in a second phase, the existence of providence seemed pointless in a universe which seemed increasingly to be bereft of the direct presence and intervention of the deity. Man lost sight of the godhead. Charles Lyell's publication of *Principles of Geology* in 1830 greatly contributed to this sentiment.

Lyell argued in 1830 for Hutton's uniformitarianism in his "attempt to explain the former changes of the earth's surface, by reference to causes now

in operation.”³⁷ Lyell, therefore, challenged the existence of “former worlds,” and, apart from allowing geology the time it needed, he denied the occurrence of a universal deluge. A universal flood did not tally with his geological evidence, nor did it conform to his anti-catastrophist ideas that “*natura non facit lapsus*.” There was no place for the flood in the economy of nature. He condemned it as rash and unphilosophical to assume that in the past powers had been at work different either in kind or intensity from the ones still in operation.

Noah’s flood had been a kind of safety-valve during the decade preceding Lyell’s *Principles*, when geology threatened to blow up the entire Mosaic system by demanding more time than Genesis could warrant in its six-day creation, a problem even educated clergymen could no longer dodge.³⁸ Clergymen were less willing to give up the reality of the Deluge, which, they argued, was the beginning of the present state of the earth. But it was Lyell’s sense of universal laws governing in an even and non-catastrophic way geological changes, both in the past and in the present, which seemed to dispense with the constant intervention of God on earth. An indirect attack on the existence of providence seemed implicit to many of his contemporaries.

The vastness of time had become a numbing factor in man’s contemplation of the universe and his place in it. In literature Alfred Tennyson was one of the first to respond to a redimensioning of the status of man. The Victorian religious novel initially ignored the implications of deep time, but picked it up after the impact of *The Origin of Species* on its reading public. From Tennyson’s desperate struggles to fit science and religion into one coherent system in the 1830s to George Eliot’s religious humanism of the late 1850s and 1860s, we can trace a movement in which geological time is finally seen as a liberating force, which removes man from the centre of the creation yet gives him back his humanity.

³⁷ The full title of Lyell’s book is: *Principles of Geology, being an attempt to explain the former changes of the earth’s surface, by reference to causes now in operation*.

³⁸ See also Chadwick, *The Victorian Church*, i.563.

PART ONE
CHARLES LYELL

CHAPTER TWO

THE PERIOD TO 1830: FROM FORMER WORLDS TO UNIFORMITARIANISM

Born in 1797, Charles Lyell grew up in a politically turbulent period. His boyhood, however, passed quietly enough. His father was an active amateur naturalist who travelled extensively before he inherited his father's estate in Kinnordy, Scotland. The Lyells had a lease on Bartley Lodge at Lyndhurst (Hampshire) and this is where Charles grew up. The New Forest environment offered a lot of interest to Charles Lyell the elder, who indefatigably botanized, corresponded about his finds with the famous botanists James Sowerby, William Jackson Hooker and Robert Brown, and bought books for his library on natural history. For his son Charles, the grounds of Bartley Lodge held equally fascinating objects. In his autobiography, written for his wife in 1831, he records his early interest in nature and his first efforts in naming:

I knew every tree, great and small, and used to miss them as you might a piece of old furniture in a room. To every clump and single tree in the park I gave a name. One was "Ringwood," another "Salisbury," or "London," or "Paris" &c. Single trees were named after flowers, an odd fancy: thus one was called "Geranium."¹

Both the library, which was regularly updated with the latest books from London, and the family interest in natural history helped to stimulate an innate love for exploring and collecting.

We do not know much about Lyell's early religious attitudes. As a child he was most happy to escape church service by going for walks in the country.² The Lyells were Anglicans, but did not move in specifically religious circles. His greatest religious influence was probably John Milton, a copy of whose *Paradise Lost* he won in a contest for reciting poetry at school at Midhurst.³ Milton soon became Lyell's favourite English poet, and in later life he would often quote Milton in his geological works. What intrigued Lyell in Milton's *Paradise Lost* must have been similar to Darwin's initial interest in it, or Charles Kingsley's fascination with Spenser's *Faerie Queene*. Both *Paradise Lost* and *The Faerie Queene* share a dramatic description of life on earth,

¹ LLL i.8.

² 'Autobiography' in LLL i.6,30.

³ LLL i.24.

which could not but appeal to the imaginative mind of a scientist investigating nature. The multitudinousness and variety of life comes out forcibly in both authors. The use Lyell made of *Paradise Lost* in his works reveals his imaginative approach to his science, which, indeed, at times assumes epic dimensions; a poetically effective moment in his second volume of *Principles of Geology* is worth citing:

A scanty number of minute individuals, only to be detected by careful research, are ready in a few days, weeks, or months, to give birth to myriads [...] The swarming myriads depart which may have covered the vegetation like the aphides, or darkened the air like locusts. In almost every season there are some species which in this manner put forth their strength, and then, like Milton's spirits which thronged the spacious hall, "reduce to smallest forms their shapes immense"—

—So thick the æry crowd
Swarm'd and were straiten'd; till, the signal given,
Behold a wonder! they but now who seem'd
In bigness to surpass earth's giant sons,
Now less than smallest dwarfs.⁴

The first two decades of the nineteenth century saw the discoveries of fossil animals whose anatomical structures dazzled the imagination. It was as if the palaeontologists were discovering worlds peopled by creatures similar to the fictitious beings of the epic poems. That they were reminded of many a passage in Milton's *Paradise Lost* is without doubt. William Buckland, for example, in his description of the flying lizard, the pterodactyl, borrows thus a poetic description from *Paradise Lost*:

Thus, like Milton's fiend, all qualified for all services and all elements, the creature was a fit companion for the kindred reptiles that swarmed in the seas, or crawled on the shores of a turbulent planet.

'The fiend,
O'er bog, or steep, through strait, rough, dense, or rare,
With head, hands, wings, or feet, pursues his way,
And swims, or sinks, or wades, or creeps, or flies.'⁵

The features of these flying reptiles were easily associated with the evil spirits in Milton's poem. In 1826 Lyell reflected in an article he wrote for the *Quarterly Review* on the fact that these flying lizards recall "forcibly to our collection the winged dragons of fabulous legends." In his analysis of the similarity between the monsters of palaeontology and the ones in epic poetry he finds that "in fabricating imaginary animals the licence of fiction does not

⁴ *Principles* ii.135. See also Lyell's use of Milton in "Scientific Institutions" p.154, "Transactions of the Geological Society of London" p.538; *Principles* i.431, iii.89,90,380; *Scientific Journals*, pp.181, 229, 299.

⁵ *Geology and Mineralogy* i.219.

extend to extravagant violations of known analogies, but merely to the combination of parts and functions never yet seen to co-exist.”⁶

Thus, notwithstanding its dazzling display of the creation, Milton’s poem presupposes order and universal unity of plan. Lyell’s description of the earth, past and present, proceeded in an analogous way: describing the seemingly haphazard way of nature in order to reach the underlying principles of the creation. The unity of design is a postulate in Lyell’s system of the organic and inorganic worlds.

The spiritual qualities of *Paradise Lost*, moreover, squared well with Lyell’s view of man’s place in nature as it comes to the surface in his later writings. His concept of the plan of the creation remained strongly anthropocentric throughout his life, and he subscribed to Milton’s view of man’s history as eventually a celebration of hope and progress (“the world was all before them”). Lyell’s belief in man’s unique capacity for material, intellectual and spiritual progress could almost be read along the lines of *Paradise Lost*: his quest for truth in science leads him to a situation which could well be symbolized by the eating from the tree of knowledge; and like Adam and Eve, who have to leave Eden in quest of the world to reach a higher state of spirituality, Lyell, when, in later years, scientific discovery deeply confounded his religious world view, admitted:

Not that the difficulties & doubts do not rapidly augment but that with increasing psychological developm.⁴ there is more revelation of the spiritual from the only source from which it can spring, from the spiritual intercourse & communion, with something internal & external & not of this earth.⁷

Lyell remained convinced of man’s (divine) dignity to the end of his life. Charles Darwin, who had taken a copy of *Paradise Lost* with him on his voyages on board the *Beagle*, lost his interest in Milton’s poem in later life, whereas Lyell did not. It is an indication of two different temperaments, and helps us to appreciate why Darwin was unable to understand Lyell’s spiritual qualms when he was, in the late 1850s and early 1860s, confronted with evolution.⁸ Lyell remained loyal to an underlying idea of providence which had gradually proved meaningless to Darwin or to Thomas Henry Huxley. To the latter Milton significantly became the anti-evolutionary; when lecturing on evolution in America in 1876 Huxley opened a copy of *Paradise Lost* on his reading desk and proceeded from there to attack orthodox views.⁹

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⁶“Transactions of the Geological Society of London. (henceforward “Transactions”), p.524.

⁷ *Scientific Journals*, p.298.

⁸“I would give absolutely nothing for the theory of Natural Selection, if it requires miraculous additions at any one stage of descent,” (Darwin to Lyell, October 11, 1859, *The Life and Letters of Charles Darwin* ii.210-11).

⁹ See “Lectures on Evolution” (1876), in *Science and Hebrew Tradition*, pp.52ff. Huxley was

In 1816 Lyell enrolled at Oxford. Like his father, he went to university with an eye to reading for the bar rather than entering the church. As for geology, Oxford in these days did not offer any regular courses in natural science, as examinations were limited to mathematics, classics, divinity and moral philosophy. Lectures in natural science, however, were given, but were not well-attended.¹⁰

Lyell's first interest in geology can be traced back to his reading a copy of Bakewell's *Introduction to Geology*, which his father added to the family library in 1816. It was Bakewell's idea, undoubtedly influenced by James Hutton, that the earth was much older than the Mosaic account led to suppose. The fact struck the young Lyell.¹¹ Bakewell's was not the work of an atheist, however: he firmly believed, in a truly eighteenth-century spirit, that geology was the discovery of the "wise provision of the author of nature".¹²

Having been made curious by Bakewell, Lyell decided to attend William Buckland's lectures on mineralogy in 1817. Buckland had been Reader in Mineralogy at Oxford since 1813 and his exuberant personality had done much to make the science popular to Oxford students, and he did not fail to enchant Lyell.¹³ Buckland was an ordained clergyman of the Anglican Church—in 1825 he was appointed Canon of Christchurch Cathedral, Oxford; he ended his career as Dean of Westminster—and his approach to geology was in the same strain of natural theology Lyell knew from Bakewell and, probably by this time, from Paley. Actually, geology in the 1820s was not as much in opposition to received religious ideas of the history of the earth as is often assumed; most geologists saw their discoveries as revealing God's work, and those who were aware of discrepancies avoided open conflict with it. Buckland and many other geologists had not the slightest problem in explaining a longer past for the earth: they held that the obvious antiquity of the fossils belonged to a time before the Earth's estimated biblical age of approximately six thousand years. James Parkinson's title for his book is typical in this respect: *Organic Remains of a Former World*. To what extent 'former worlds' before the six-day creation was an easy way out to calm alarmed consciousnesses is difficult to assess. Initially, before the idea was fully developed, it is likely that an excuse was found in it which would justify the then so popular hobby for clergymen. But as 'former worlds', repeatedly destroyed and recreated, seemed scientifically irrefutable—the concept was supported by Cuvier's

criticized for this in the *Sun*: "Instead of attacking Moses over the shoulders of John Milton, he should strike at Moses, face to face" (quoted in Irvine, *Apes, Angles and Victorians*, pp.297-8).

¹⁰ For an account of science and the English Universities in the nineteenth century see Heyck, *The Transformation of Intellectual Life in Victorian England*, pp.50-80.

¹¹ LLL i.32.

¹² *An Introduction to Geology*, p.192.

¹³ "Buckland's Mineralogy lectures are engaging him heart and soul"; Lyell sr. to Dawson Turner 4 June 1817, quoted in Wilson, *Charles Lyell*, p.44. In the summer of 1817 Lyell is, moreover, collecting information for Buckland; see his letters to his father from Yarmouth, LLL i.41,44.

catastrophic theories, based on his authoritative collection of fossils¹⁴—the glaring omission of it in Genesis might make religion the worse for it. Therefore, clergymen-geologists started on a crusade of reconciliation, of Mosaic geology, which was to last for most of the century, and soon defended the idea of ‘former worlds’ as not damaging Genesis in the least. Thus Bishop Gleig in his introduction to the *Stackhouse Bible* of 1816 warns the “pious reader” against “modern geologists” by pointing out that scripture does not exclude the existence of life before the Mosaic creation: “Moses records the history of the earth only in its present state [...] There is nothing in the sacred writings forbidding us to suppose that they [fossils] are the ruins of a former earth.”¹⁵

Lyell’s earliest amateur interpretations of geological phenomena neatly follow this pattern. Geology gave proof of wisdom in design. Obviously Buckland had instilled much natural theology in the young geologist, who accompanied him on geological excursions in the country. Lyell had also completely adopted his professor’s “former worlds”. When in 1818 he visited Cuvier’s collection of fossils at the Jardin des Plantes, he describes them as the “glorious relics of a former world.”¹⁶

At Oxford Lyell continued working hard for his degree, but the seeds of geology had been sown. He had attended two years of Buckland’s lectures and had started geologizing seriously on a trip to his father’s estate in Scotland in 1817 and on his journeys on the continent in 1818. Anti-Mosaic implications in geological finds do not seem to have troubled him much, and he went about his new hobby with true scientific zeal. In 1819 he was elected a member of the Geological Society of London.

Although most members of the Geological Society of this time had accepted a longer age for the earth, they rejected the uniformitarian principle of degree (that former change was not occasioned by forces more violent than present ones). Catastrophic theory dominated the field, and little attention was paid to the cyclic theories of nature which James Hutton had initially propounded to the Royal Society of Edinburgh in 1785 and published ten years later as *Theory of the Earth*. Lyell had read Playfair’s *Illustrations of the Huttonian Theory* by 1818.¹⁷

¹⁴ This cyclic destruction and the creation had already been expounded in the seventeenth century cosmologies of Burnet and Woodward; see *Principles* i.36-38.

¹⁵ *Stackhouse Bible*, pp. 6-7.

¹⁶ *Journal of France and Switzerland 1818* in *LLL* i.59-60,63.

¹⁷ Bailey, *Charles Lyell*, p.37. At this stage Lyell very likely knew Hutton only through Playfair. However, contrary to what Rudwick (“The Strategy of Lyell’s *Principles of Geology*, p.9) asserts, Lyell must have studied Hutton’s work later in life. Although he writes in a letter to William Henry Fitton (August 1, 1839 *LLL* ii.48): “I doubt whether I ever fairly read more than half of his writings, and skimmed the rest,” it is highly improbable that Lyell, who acknowledged his indebtedness to Hutton, who studied geological treatises in Italian (a language he did not speak), who studied German only in order to read German geological works, and who, moreover, was intimately acquainted with the subject matter, did not make the effort to read Hutton’s *Theory of the Earth*

Hutton rejected catastrophism not only because it ran counter to his own observations of geological phenomena, but also because it would have been unworthy of the divine design which had to underlie everything on earth. Geological change too, therefore, could only have proceeded slow and orderly. It was necessary for Hutton's faith in God's perfect principles to discard the Mosaic cosmogony, but this did not affect his profoundest religious sentiments. Uniformitarianism was proof of divine design. But the times were revolutionary, and everything that smacked of innovation was easily stigmatized infidel.¹⁸ But the controversy had calmed considerably when, about twenty years later, Lyell became acquainted with Hutton's ideas.

How much Playfair's exposition of the Huttonian theory influenced Lyell at this time is again hard to establish. While advocating present causes in 1826 Lyell still groups Werner's errors together with Hutton's:

we cannot be surprized that the theories of the earlier professors of this science, even when founded exclusively on facts and observations, were contradictory; and that the generalizations of Werner and Hutton, though bearing impressed upon them the decided marks of genius, have required considerable modifications.¹⁹

The force of Hutton's arguments was to come back to Lyell after his own observations of geological phenomena during the late 1820s. His early contribution on geology for the *Quarterly Review* is still mainly catastrophic in outlook.²⁰

Another thing Hutton later did to Lyell was to make him aware of the hostility with which uniformitarian ideas were met by religiously orthodox geologists like Kirwan, and although the controversy had almost completely died down when Lyell started attending courses of geology at Oxford, he saw himself very much as an anti-Mosaic crusader when he launched his uniformitarian ideas. It is true that his work was sometimes sharply criticized, but not often on merely religious grounds.

Lyell's post-graduate years are divided between geological pursuits and reading for the bar at Lincoln's Inn. The years to 1824 mark his growth into a professional geologist—he finally renounced the bar in 1828—and to this period the beginnings of his uniformitarian thinking should be traced.

Lyell was enchanted with Phillips and Conybeare's *Outlines of the Geology of England and Wales* published in 1822. William Daniel Conybeare was another clergyman-geologist and a close friend of Buckland's. He wrote the introduction to the book and expounded his belief that all significant

with attention, however tortuous Hutton's style might have been. I consider his comment in his letter to Fitton a comment on Hutton's style rather than on his own reading.

¹⁸ Cf. *Principles* i.67.

¹⁹ "Transactions," p.533.

²⁰ See "Transactions," pp.507,510.

elevations of land must be ascribed to volcanic causes. With this he conformed to the prevalent catastrophic ideas and he rejected uniformitarian causes as “crude and hasty speculations.”²¹ Although he was much impressed by *Outlines*, Lyell soon started drawing conclusions that were fundamentally different from Phillips and Conybeare’s.

While in Paris in 1823, his father’s fame allowed Lyell to visit most of the prominent scientists of the time and he attended various lectures on geology, chemistry and zoology. He became a frequent guest at Cuvier’s weekly soirées where he met Constant Prévost. Cuvier was without doubt the leading French catastrophist who insisted on repeated creations of new species after catastrophes had done away with the previous series of species. His conclusions were supported by his explanations of alternating strata of marine and fresh-water origin in the Paris basin. These strata, he maintained, could overlay each other only if sudden and powerful cataclysms had rigorously changed the face of the earth. The French geologist Prévost, however, had reached different results from his studies of the alternation of these marine and fresh-water deposits; he came to the conclusion that the different sediments were deposited gradually one over the other in a saltwater inlet of the sea which was slowly turning into a freshwater lake through the agency of rivers flowing into it. His explanation did not need to resort to Cuvier’s catastrophism, and he soon attacked Cuvier’s ideas openly. It was from Lyell’s excursions with Prévost that his earliest ideas that the geological past can be explained through “causes now in operation” stem. Years later, in a letter to Poulett Scrope, Lyell admitted his initial indebtedness of his uniformitarian ideas to Prévost.²²

Although Lyell and Buckland jointly explored various parts of Scotland in 1824, their basic geological assumptions started diverging. In this year Lyell read his first paper to the Geological Society—published in its *Transactions* in 1826²³—in which he compared the freshwater strata of the Paris basin he had examined together with Prévost to recent formations in Forfarshire. In them he had found the same fossil seed-vessels of the plant *Chara* he had observed in the ancient formations in the Paris basin. Moreover, studying Forfar lake, Lyell saw the formation of hard sediments at the bottom of a fresh-water lake in the process of being formed. He could thus explain past phenomena by analogy with modern ones.

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²¹ Phillips and Conybeare, *Outlines of the Geology of England and Wales*, p. xxxiii.

²² Letter to Scrope, June 14, 1830, *LLL* i.268.

²³ “On a recent formation of freshwater limestone in Forfarshire, and on some recent deposits of freshwater marl; with a comparison of recent with ancient freshwater formations; and an appendix on the Gyrogonite or seedvessel of the *Chara*”, *Transactions of the Geological Society of London*, 2, ser.2 (1826): 73-96.

In 1825 the editor of the *Quarterly Review* John Taylor Coleridge, the poet's nephew, asked Lyell to contribute scientific essays and reviews. Lyell, eager to get away from the weary and badly-paid work on the Western Circuit as a junior barrister, started on a series of articles which he continued to write for the next editor John Gibson Lockhart, Sir Walter Scott's son-in-law. After successful articles on university education and scientific institutions, Lockhart agreed on an article on the Geological Society of London. In it Lyell discusses the present state of geology as a science, with special emphasis on the principal accessions of fossil organic remains to geology, which he sees as the most remarkable progress of the science in the last few years. He briefly refers to the past revolutions in nature and the undeniable successive progression of organic life. He respects Cuvier's pronouncement that present forces could not have been responsible for past catastrophes of which we find traces in the earth's crust. But he warns that

in the present state of our knowledge, it appears premature to assume that existing agents could not, in the lapse of ages, produce such effects as fall principally under the examination of the geologist. It is an assumption, moreover, directly calculated to repress the ardour of inquiry, by destroying all hope of interpreting what is obscure in the past by an accurate investigation of the present phenomena of nature.²⁴

Lyell's geological experience had led him to recommend the principle of uniformity of kind (that former change can be explained through analogy with present forces), but he is silent about degree. Thus in his article he could easily advocate the validity of present agents for inferring the process of past geological phenomena without rejecting catastrophes which could have been caused by known causes but with unknown intensity. Most geologists, including Cuvier, would have agreed with him here.²⁵ Lyell was not saying anything revolutionary. On the whole, the tendency of this early article is that of traditional natural theology. His discussion of the "gradation of animated beings, from those of the simplest to those of the most complicated organization" is developed in a truly eighteenth-century spirit, and this chain is seen as proof of "one connected plan." The study of nature enhances Lyell's admiration for the "design and contrivance [which] in all her works are multiplied." Lyell's vision is from the beginning anthropocentric ("that grand and boundless scheme of nature, in the midst of which the human race are placed") but not narrowly utilitarian ("the support, gratification, or instruction of mankind are [falsely seen as] the chief, if not the sole ends proposed in their existence").²⁶ On the other hand, the present state of the globe with its economically important strata laid bare by subterranean forces is proof "that they are

²⁴"Transactions," p.518.

²⁵Cf. Rudwick, *The Meaning of Fossils*, p.110.

²⁶"Transactions," pp.539,508,538.

governed by general laws, and that these laws have been conceived by consummate wisdom and forethought;" and Lyell marvels how much the moral advancement of man is linked to the present position of the coal beds.²⁷

The end of the article is a crescendo of natural theological reasoning and the words seem to flow straight from Paley's pen, as for example in:

It is therefore clear to demonstration, that all, at whatever distance of time created, are parts of one connected plan. They have all proceeded from the same Author, and bear indelibly impressed upon them the marks of having been designed by One Mind.²⁸

Lyell's final affirmation, though sincerely religious, is, in his admiration for the magnificence of divine design and contrivance, paradoxical when seen in juxtaposition with his earlier claim that scientists should not prefer the obscure to the known in looking for explanations of past causes:

[our] ignorance affords a full and satisfactory answer to all the objections against the perfection of the scheme, whether of the natural or of the moral world, and thence against the wisdom, justice and benevolence of the common Parent and Preserver of them both.²⁹

Whatever the answer to a puzzling discovery may be, faith in a benevolent, wise and powerful creator comes first and foremost.

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If in his 1826 review Lyell leant to a progressionist explanation of fossil sequences, he was not aware yet of another possible explanation: transmutation. In 1827 his friend Gideon Mantell sent him a copy of Lamarck's *Philosophie Zoologique*. Although the theory delighted him ("more than any novel I ever read"), he confesses to Mantell that he read Lamarck "as I hear an advocate on the wrong side." He stresses that his objections do not originate from *odium theologicum*, but that Lamarck's argument "if pushed as far as it must go, if worth anything, would prove that men may have come from the Ourang-Outang." All the same, Lyell admired the imagination in Lamarck's argument which seemed to square so well with what he knew of the fossil record:

But after all, what changes species may really undergo! How impossible will it be to distinguish and lay down a line, beyond which some of the so-called extinct species have never passed into recent ones.³⁰

If the problem for Lyell did not lie in *odium theologicum*, nor in the evidence

²⁷"Transactions," p.537.

²⁸"Transactions," p.538.

²⁹"Transactions," p.540.

³⁰ Letter to Mantell, March 2, 1827, *LLL* i.168.

from species, where then did it exist? Lamarck's theory clearly troubled Lyell, and he kept turning it over in his mind, as if the theory did not merely come from "an advocate on the wrong side." In one of his notebooks he writes of Lamarck's theory:

It is merely to prop the world on an elephant & and the elephant on a tortoise to say that the higher animals came from the simpler, formed by gradual development. For it is as great an act of power to create an infant which shall in 20 years acquire the full powers of manhood as to create a full grown man in the perfection of his faculties. What is it but a vain attempt to push back into more remote obscurity that wh. we cannot account for?³¹

Whether special creations or transmutation are responsible for species, neither would diminish the power of the Creator, as in both cases there must have been an initial act of creation. To resort to spontaneous creation is simply absurd to Lyell.

Lyell pondered the consequences of transmutation for his faith in the divine origin of the present plan of nature, and more particularly the dignity of man. He seemed troubled. He saw clearly enough that Lamarck's theory would minimize the link of God to his creation, and remove his direct relationship to man. The discovery of a mammiferous jawbone in the Stonesfield slate—an ancient secondary formation—came to Lyell's rescue. He had already referred to it in his 1826 review, and now he held desperately to it to show the incompleteness of the fossil record and the existence of mammals throughout geological history. On these grounds he was to reinterpret Lamarck's evidence and to dismiss his theories, briefly in the first, and then in detail, in the second volume of *Principles*.³²

Now Lyell, inspired by Jane Marcet's fashionable book on chemistry (*Conversations in Chemistry*, 1806), started planning a similar work on geology, in which he was to popularize the science for the general reading public.³³ His new views of the analogy between ancient and modern causes in the formation of the earth's crust, however, soon impelled him to abandon this project for a more professional kind of book,³⁴ in which he would have to fight the theologically acceptable catastrophist ideas. His ripening uniformitarian ideas made it impossible to escape the conclusion that the biblical account obstructed a clear and unprejudiced view of his scientific method. Moses made the present state of the earth young and advocated progressionism. Although most geologists had accepted time before the Mosaic account, Lyell needed

³¹ Notebook 5, entry dated August 3, 1827, quoted in Wilson, *Charles Lyell*, p. 181.

³² See *Principles* i. 144-166, ii. 1-65.

³³ See letter to his father, April 10, 1827, *LLL* i. 170.

³⁴ In a letter to Gideon Mantell of February 5, 1828 we read: "I felt that in a subject where so much is to be reformed and struck out anew, and where one obtains new ideas and theories in the progress of one's task, where you have to controvert, and to invent an argumentation - work is required, and one like the 'Conversations on Chemistry' and others would not do," (*LLL* i. 177).

limitless time for a steady state-system where there was no break between past and present. Mosaic cosmogony shackled true scientific inquiry. It is, therefore, not surprising that he concludes a review of Poulett Scrope's *Geology of Central France*, written for the *Quarterly Review* in 1827, with a powerful appeal for religious tolerance in science: "we must recollect that the Mosaic narration is elliptical in the extreme, and that it makes no pretensions whatever to supply those minute scientific details which some would endeavour to extort from it." Of course, this did not imply a denial of a divinely inspired universe. On the contrary, Lyell seems as much worried about the injury done by such an interference to science as to religion:

We are sometimes tempted to ask ourselves whether the first sentence of the sacred writings has ever made a due impression on their minds,— whether, if the important truth that God created the heavens and the earth, was ever present to their recollection, they would not pause before instituting a comparison between the scriptures and the works of nature; and first consider whether, by a total disregard of either description of evidence, they may not incur the most serious moral responsibility.³⁵

In May 1828 Lyell decided to accompany Roderick Murchison and his wife on an excursion to the Central France of Scrope's book. He was not to return to England until the beginning of 1829, and this meant the end of his career as a barrister. In the Clermont-Ferrand area he found abundant proof to refute Buckland's diluvianist theories that river valleys could only have been formed by a deluge, not by the mere erosion of the rivers themselves.³⁶ Lyell writes triumphantly to his father that "this is an astonishing proof of what a river can do in some thousand or hundred thousand years by its continual wearing."³⁷ Studying the formations of Cantal, moreover, he found additional proof of the enormous amount of time needed for geological formations and they also decided that the age of strata could not be determined in a reliable way from their mineral contents, but could only be classified according to the fossil remains in them.³⁸

From a passage in his notebook it also becomes clear that Lyell is now firmly breaking away from the eighteenth-century narrowly utilitarian view of providence of which we still find traces in his 1826 review of geology:

The danger of misjudging, and giving way to false theories in regarding the

³⁵ "Scrope's *Geology of Central France*," pp.482-3.

³⁶ They published their conclusions in a joint paper read by Murchison to the Geological Society in 1829.

³⁷ May 26, 1828, *LLL* i. 187. Compare also: "We have been much surprised that ever since we left the chalk and oolite, and entered the freshwater formations along the Allier, we have never seen, till we came close to Clermont, *any* volcanic pebbles in the gravel, which was chiefly granitic. If most of the volcanoes were antediluvian, and Buckland's deluge caused the diluvium, how could this have happened?" (Letter to his father, May 16, 1828, *LLL* i.185).

³⁸ Lyell later laid the basis for the classification of Tertiary formations according to the percentage of recent fossils found in them.

system of nature, is when we view it as solely and expressly adapted for the existing order of things, and when we are ignorant that it is merely a subordinate part of a great series of events intended to embrace many such systems.³⁹

France confirmed his budding uniformitarian ideas. About a year before setting out with Murchison, he had written to Mantell that he “was going to write in confirmation of ancient causes having been the same as modern.”⁴⁰ Now he writes to his father that

the whole tour has been rich, as I anticipated [...], in those analogies between existing Nature and the effects of causes in remote eras which it will be the great object of my work to point out. I scarcely despair now [...] of *proving* the positive identity of the causes now operating with those of former times.⁴¹

When the Murchisons returned to London in August, Lyell decided to travel on to Sicily to find answers to the many questions France had raised in his mind. The south of Italy and Sicily convinced him of the enormous span of geological time, it consolidated his idea of ‘struggle for survival’, and it showed the fallacy of ascribing the present state of the globe to what in 1826 was still the ‘last extensive revolution’—the Mosaic flood. Revelation could not hold any longer and he felt more than ever the necessity to free the science from its Mosaic restraints, witness, for example, the following passage:

There is in the Campagna di Roma a beautiful chain of alluvial phenomena, which, but for Moses and his penal deluge, would have thrown more light than any part of Europe on the modern ages of the earth’s history.⁴²

The results of this geological trip gave him the direct material for much of his *Principles of Geology* and made it possible to create an ideal uniformitarian system. The perfection of the system, however, was still conceived of as divine design and contrivance.

³⁹ Notebook 12, p.86, quoted by Wilson, *Charles Lyell*, p.216.

⁴⁰ March 2, 1827, *LLL* i.169.

⁴¹ August 24, 1828, *LLL* i.199.

⁴² Letter to Murchison, January 22, 1829, *LLL* i.240.

CHAPTER THREE

"IF WE DON'T IRRITATE, WE SHALL CARRY ALL WITH US": THE FIRST VOLUME OF *PRINCIPLES OF GEOLOGY*

Lyell's history of geology and the mosaicists

Recently, historians of science have pointed out that the intensity of the uniformitarian-catastrophist debate has often been greatly exaggerated, and that the leading catastrophists were far from being dogmatic mosaicists.¹ Lyell's private papers, however, display a greater awareness of possible controversial aspects of his theory about religion than the contemporary scientific situation seemed to justify. This uneasiness can be explained if we distinguish in his work a twofold purpose: on the popular level he is dealing with the dogmatic mosaicists and the public opinion of geology, whereas on the scientific level he is combating directionalist views of geology.

Lyell's letters often disclose a fear of irrupting into the domain of traditional religious beliefs by running counter to the Mosaic account of the creation in Genesis. He rightly saw books like Andrew Ure's *New System of Geology, in which the Great Revolutions of the Earth and Animated Nature, are Reconciled at once to Modern Science and Sacred History* (1829) as expressions of the popular religious approach to geology from which the science needed to be liberated. But it was very likely religion which was in need of being freed from such reconciliation, not geology. Few professional geologists would take such geological works seriously. Yet Lyell shows a particular sensitivity on this point. He seems painfully afraid of accusations of infidelity which would smear his public reputation. Professional clergymen-scientists like Sedgwick, Whewell, or Buckland, however, never saw Lyell's *Principles* as anti-religious in purpose, and never doubted its author's religious convictions. It seems, then, that Lyell worried much about the preconceived notions of the reading public at large, which was too important to be ignored. His crusade against rigidly theological interpretations of natural phenomena was necessary if he wanted to put his science not only on a new methodological basis, but also on a new philosophical one.

¹ Hooykaas, *The Principle of Uniformity*, pp.45-6; Cannon, "Charles Lyell, Radical Actualism, and Theory," p.108-9; Rudwick, "The Strategy of Lyell's *Principles of Geology*," p.10; Bartholomew, "The Singularity of Lyell," pp.277-78; Porter, "Charles Lyell and the *Principles of the History of Geology*," p.98; Gould, *Times's Arrow, Time's Cycle*, p.117.

Fanatical religious dogmatism in science exasperated Lyell. Thus, for example, he writes to his sister Marianne:

Longman has paid down 500 *guineas* to Mr. Ure of Dublin for a popular work on Geology, just coming out. It is to prove the Hebrew cosmogony, and that we ought all to be burnt in Smithfield. So much the better. I have got a rod for the fanatics, from a quarter where they expect it not. The last Pope did positively dare to convoke a congregation, and *reverse* all that his predecessors had done against Galileo, and there was only a minority of one against; and he instituted lectures on the Mosaic cosmogony to set free astronomy and geology.²

Notwithstanding the humour in this instance, Lyell saw popular prejudice as a serious threat to the progress of science. From Auvergne he writes to his father about Count Montlosier, who was asked by Marcel De Serres to become president of the geological society of Clermont-Ferrand. The Jesuits, however, took alarm and declared that Montlosier had written a book against Genesis. They appealed to the local authorities and to the Government to oppose the nomination and as a result the geological society never got off the ground.³

Lyell's conviction that he had to use his legal skills in arguing a case in defence of his geological discoveries against a religious outcry that might check the progress of his science for another century should be seen in this context. From the start Lyell knew that his reading public would not only consist of professional geologists—and he did not want it to consist of geologists only—but also of the generally educated reader. His emphasis on style is indicative of this. Lyell's book should therefore also be seen in the light of a popularizer of science. Witness, for example, how he justifies himself at the end of the third volume of *Principles* in presenting the reader with a glossary of scientific terms used:

Several of the Author's friends, who had read the first and second volumes of the *Principles of Geology*, having met with difficulties from their previous unacquaintance with the technical terms used in Geology and Natural History, suggested to him that a Glossary of those words would render his work much more accessible to general readers [...] It will be obvious to men of science that in order to attain the object in view, it was necessary to employ illustrations and language as familiar as possible to the general reader.⁴

The fact that Lyell aimed at two different kinds of readers implied that, on the one hand, scientists should not keep hypotheses reached by sound scientific reasoning to themselves if they ran counter to traditional religious notions, but it also meant they ought not to shock the public unnecessarily in presenting these hypotheses. Lyell's sensitivity on this point becomes palpable in a letter to Gideon Mantell, in which he expresses contempt for another geologist's way of presenting his facts; he writes, "I think he ran unnecessarily counter to the

² January 21, 1829, *LLL* i.238.

³ Letter to his father, May 26, 1828, *LLL* i.187-188.

⁴ *Principles* iii, Glossary, 61.

feelings and prejudices of the age. This is not courage or manliness in the cause of Truth, nor does it promote progress.”⁵

Lyell’s sister-in-law, when editing the letter in question for *Life, Letters and Journals*, found cause to conceal the name of the geologist criticized here.⁶ The original letter, however—now possessed by the Alexander Turnbull Library, Wellington, New Zealand—reveals the name of a Dr. Toulmin,⁷ which with all probability refers to George Hoggart Toulmin (1754-1817), author of a rather provocative pamphlet entitled *The Antiquity and Duration of the World*, published in 1780. It ran through four editions in ten years with slightly different titles and was reprinted as late as 1837, which testifies to its popularity. Lyell might have read the 1824 reprint of the first edition, or nearer the date of his letter to Mantell, the 1825 reprint of the fourth edition entitled *The Eternity of the Universe* (1789).

Although the uniformitarian ideas Toulmin put forward in his book have been studied in relation to Hutton’s, his influence on Lyell’s ideas has mostly gone unnoticed.⁸ Thus, Lyell’s biographer, Leonard G. Wilson, does not seem to be aware of the influence of Toulmin’s work when Lyell was forming his first uniformitarian ideas. The case is an interesting one, as he is ignored by Lyell himself in the chapters on the history of geology, and except for his letter to Mantell, we would not even be sure whether he knew Toulmin’s book or not. As it is without doubt that Lyell *was* aware of the existence of Toulmin’s work, a short discussion of Toulmin’s *Antiquity* contributes to a better understanding of his relationship to Lyell’s ideas and the strategy he employed in presenting them.

Toulmin’s geological ideas are basically uniformitarian. The operations of nature, he writes, are “uniform and undeviating” and natural history teaches us that there have been “eternal revolutions of events.”⁹ He does not see nature

⁵ December 29, 1827, *LLL* i.173.

⁶ Gliserman in “Early Victorian Science Writers and Tennyson’s *In Memoriam*” erroneously assumes that Lyell refers to Poulett Scrope in this letter (p.299); her guess obscures the significance of the letters to Scrope in 1830, and thus adversely affects much of her argument on Lyell.

⁷ MS. Papers - 0083-061 (quoted with permission of the Alexander Turnbull Library, Wellington). It is not entirely clear why Lyell wrote to Mantell about Toulmin’s book. As he does not introduce the subject in the letter, one might expect earlier discussion of Toulmin in a preceding letter. Lyell’s previous letter of December 10 is void of geological discussion, however. Mantell’s letters anterior to 1831 have unfortunately been lost. T.J. Lovell-Smith of the Alexander Turnbull Library pointed out to me that, as Lyell was staying at Mantell’s home between 14 December and 18 December, they might well have discussed Toulmin’s work. In fact, the entry of December 15 of Mantell’s unedited diary states that “we sat up very late, conversing on Geological subjects” (Gideon Mantell Diary, p.131, qMS-1297-1298, quoted with permission of the Alexander Turnbull Library, Wellington).

⁸ See, for example, Davies, “George Hoggart Toulmin and the Huttonian Theory of the Earth;” Porter, “Philosophy and Politics of a Geologist: G.H. Toulmin (1754-1817);” Porter, “George Hoggart Toulmin’s Theory of Man and the Earth in the Light of the Development of British Geology”; in the last-mentioned article Porter briefly mentions Lyell’s acquaintance with Toulmin’s work.

⁹ *Antiquity*, pp.21,39. All references to Toulmin are to the second edition entitled *The Antiquity of the World* (London, 1783).

as progressive, but rather as cyclical, so that “as there never was any beginning, [...] there never [will] be a conclusion to the existence of vegetables, animals, the world, the universe.”¹⁰ The main shaping forces of the surface of the earth are briefly discussed (volcanoes and earthquakes on the one hand, and erosion and sedimentation of oceans and rivers on the other) and he states emphatically that a universal flood cannot be defended in the face of scientific facts and that man’s insistence on it is merely an example of how in the various annals of mankind the ignorant of uncivilized times exaggerated local incidents. The Mosaic narrative, one feels, falls under this heading.

From the above it becomes clear that Toulmin clearly anticipated the statement Lyell borrowed so repeatedly from Hutton in his *Principles*: that the geologist can find no vestige of a beginning, no sign of an end. The eternally dynamic and balancing tendencies of igneous and aqueous causes mentioned by Toulmin are at the very core of *Principles*, and Toulmin’s denial of a universal deluge finds its expression in Lyell’s quarrel with Moses. Writing of the ocean, Toulmin seems to set the tone of so much of Lyell’s writing, witness, for example:

That restless element, on the other hand, gradually forsaking its ancient boundaries will leave the districts it now covers prepared for scenes of luxuriant vegetation,—for the happy settlements of succeeding generations.¹¹

Toulmin even touches on the bewildering impact of the age of the earth on the human imagination, an element with which Lyell repeatedly tried to come to terms.¹² He also recognizes the principle of continuous struggle, that “though men are seen to die, or change existence, the human species flourish in eternal being” and that therefore “a continual waste in every part is necessary to the incessant repairs of the whole.”¹³

In view of the general agreement of geological opinion between the two, it is surprising that Lyell remains silent about Toulmin in his published works. He is not even mentioned in the introductory chapters on the history of geology in *Principles*. Admittedly, Toulmin’s work probably does not merit a place amongst the great scientists Lyell lists, but the letter to Mantell explicitly shows that Lyell very much resented the aggressive and atheistic tone of Toulmin’s writing. Rather than showing the antiquity of the earth, Toulmin seems obsessed by demonstrating the narrow-mindedness of most scientists.

¹⁰ *Antiquity*, p.192. Compare also the following conclusion of the *Antiquity*: “the world, the human species, and the whole system of things, never had any beginning, nor will they have any termination, but ever have existed and ever will exist,” p.208.

¹¹ *Antiquity*, p.133; cf. *Principles* i.255.

¹² “In the circle of existence, in vain do we seek for the beginning of things. How absurd and fruitless every recourse to calculation on the subject of antiquity! The stretch of human conception necessarily fails us,” (*Antiquity*, p.190).

¹³ *Antiquity*, pp.116, 204; see also Porter, “Philosophy and Politics of a Geologist,” p.440.

Although he never specifies his attacks, his cutting remarks are often levelled at Genesis and the Church. The following extract is a good sample of this:

The inhabitants of a celebrated portion of the globe stile themselves the rational, the civilized, the intelligent of mankind. Yet, with all their boasted knowledge, are they not absurd enough to confine the existence of the world, and its appendages, the unbounded scenes of nature, to the trifling limits of a few thousand years? [...] Children of a day, they have given but a day to the existence of nature! [...] Unwilling to depart from such degrading and unwarrantable conclusions, they are even disposed to censure those who vindicate the cause of nature and of truth.¹⁴

Elsewhere Toulmin styles these scientists rather unflatteringly “men whose ideas are cramped by the fetters of superstition.”¹⁵ Lyell’s silence about Toulmin’s book, then, as his letter to Mantell suggests, should be seen as an example of the diplomatic stance which can be observed throughout Lyell’s first volume of *Principles*, where he put religious controversy as much in the background as possible.

But there might be more to it. When the first volume of the *Principles* came out in July 1830,¹⁶ its readers were confronted with a 91-page history of geology, which served as an introduction to a new geological theory which sustained an immense past for the earth and a slow but continuous process of geological change. Right at the beginning Lyell draws a parallel with history, and he emphasizes the “long series of events” that “gradually” have led to the present state of affairs. In history, he writes, we obtain a more profound insight into human nature by comparing present and past states of society. As the present is the result of antecedent changes, be it remote or recent, gradual or violent, “so the state of the natural world is the result of a long succession of events.”¹⁷ When he later returns to this comparison, he emphasizes that the infinite slowness of change is prerequisite to true geological thinking, because otherwise geology becomes a mockery of past events:

How fatal every error as to the quantity of time must prove to the introduction of rational views concerning the state of things in former ages, may be conceived by supposing that the annals of the civil and military transactions of a great nation were perused under the impression that they occurred in a period of one hundred instead of two thousand years. Such a portion of history would immediately assume the air of a romance; the events would seem devoid of credibility, and inconsistent with the present course of human affairs. A crowd of incidents would follow each other in thick succession. Armies and fleets would appear to be assembled only to be destroyed, and cities built merely to fall in ruins. There

¹⁴ *Antiquity*, pp.187-90.

¹⁵ *Antiquity*, p.35.

¹⁶ Lyell finished the manuscript of the first volume around June 22, 1830 (Wilson, *Charles Lyell*, pp.273, 278).

¹⁷ *Principles* i.1.

would be the most violent transitions from foreign or intestine war to periods of profound peace, and the works effected during the years of disorder or tranquillity would be alike superhuman in magnitude.¹⁸

Geology becomes a mere romance, “devoid of credibility” and “inconsistent” with the present reality, if a similar gradual change during an enormous stretch of time is ignored.

The uniformitarian premises are fair enough, but one of the problems with Lyell’s history of geology in the first five chapters is that he does not describe the history of geology as a “long succession of events,” but actually stages his geological supermen in “thick succession.” Moreover, Lyell’s objectivity is questionable. Roy Porter has argued that Lyell’s emphasis on the uniformitarian-catastrophist controversy is “a false consciousness, [...] a simplistic dichotomy [which] vulgarizes the multiplicity of stances between pure uniformitarianism and pure catastrophism.”¹⁹ This view is supported by Lyell’s silence about Toulmin, whose early uniformitarian ideas conformed to his own more than he cared to acknowledge. Although Martin Rudwick has argued that Lyell, in writing the history of geology, is at pains to create his own antecedents, one cannot but feel that Lyell is unnecessarily critical about the forerunners of uniformitarian thinking he does mention.²⁰ He easily finds fault to diminish merit. Thus, for example, he acknowledges that Robert Hooke recognized the importance of fossil remains, but then adds that he “became involved in countless difficulties and contradictions;” that Lazzaro Moro described volcanic action with great judgment, but undertook “the adaptation of every part of his own system to the Mosaic account of the creation;” and that Hutton advocated that past changes were the same as existing causes, but that he “made no step beyond Hooke, Moro, and Raspe.” One gets, indeed, the impression that Lyell is playing down the importance of his uniformitarian precursors in order to dissociate his new principles from past science. Lyell’s final evaluation of these geologists is significant: “Neither of these theories considered singly, satisfies all the conditions of the great problem, which a geologist, who rejects cosmological causes, is called upon to solve.”²¹

We know from his letters that Lyell saw his *Principles* as “creating the science of geology,” and as such we should judge his historical sketch of geology. It meant a dissociation with former writers. Unless we assume that it was part of Lyell’s strategy, it will be hard to account for his methodological blindness to his own historical approach. It could hardly have escaped him

¹⁸ *Principles* i.78-79.

¹⁹ “Charles Lyell and the Principles of the History of Geology,” p.98.

²⁰ “The Strategy of Lyell’s *Principles of Geology*,” p.9. Rudwick adds, however, that “Lyell’s highly ‘Whiggish’ interpretation of the history of geology naturally entails distortion and oversimplification” (p.10).

²¹ *Principles* i.35,43,63-4.

that, while he first advocates a continuous narrative of gradual development for the history of man and the history of the earth alike, he immediately after ignores this principle in his historical sketch—the principle of a gradual process actually featuring in the title. Moreover, we should not forget that, after all, Lyell was a well-trained barrister who would know how to plead for his own place in the history of geology, and that is what he seems to be doing here.²² If, on the one hand, Lyell wanted to make sure of the impact of his *new* theory, on the other, he wanted to avoid being stigmatized as a revolutionary. This was part of Lyell's dilemma. Open disregard for Mosaic geology would have reminded his contemporaries of Toulmin's scandalizing book.

Lyell's device testifies to great intelligence. He must have been aware that his position was not altogether different from Toulmin's. He had picked up uniformitarianism as a leading principle in geological thinking, and he shared Toulmin's contempt for religious superstition. Toulmin's work was infamous for its atheistic notions. Lyell was far from being an atheist, and he cared for his reputation. Therefore he ignores Toulmin in his historical sketch, while he tries to convey a similar message, not by attacking the clergy in Toulmin's blundering way—running “unnecessarily counter to the feelings and sentiments of the age”—but indirectly by a veiled attack on the Moslem attitude to scientific investigation. He relates, for example, how in the tenth-century 'Omar al-Ālim wrote a treatise on the gradual retreat of the sea which “required a greater lapse of ages than was consistent with Moslem orthodoxy.” He had to recant his errors publicly and went into voluntary banishment to avoid persecution. A sneer at Genesis and its fundamentalist interpretation is lightly disguised in Lyell's opinion of the Koran: “The cosmological opinions expressed in the Koran are few, and merely introduced incidentally; so that it is not easy to understand how they could have interfered so seriously with free discussion on the former changes of the globe.”²³ Later Lyell regretted this too-obvious outburst against orthodox religion and cut it in later editions of *Principles*.

Next he comments on the Italian writers of the early sixteenth century. Of Fracastoro he writes that he “demonstrated the futility of attributing the situation of the shells in question to the Mosaic deluge, a theory obstinately defended by some [... His] evidence would have terminated the discussion forever, if the passions of mankind had not been enlisted in the dispute.” Lyell cleverly creates historical distance in order not to offend when he proceeds that

the talent and argumentative powers of the learned were doomed for three centuries to be wasted [... because] it had been the consistent belief of the

²² Cf. Porter, “Charles Lyell and the *Principles of the History of Geology*,” p. 91: “[Lyell] forged myths about his place in the geological pantheon.”

²³ *Principles* i. 22-3.

Christian world, down to the period now under consideration, that the origin of this planet was not more remote than a few thousand years.²⁴

The critique limited to “the period now under consideration” is subtly aimed at many of his own contemporaries who still held similar views. Strangely enough this subtle approach is rudely interrupted by a rather blunt unlyellian conclusion, which comes dangerously near the ones for which he had blamed Toulmin:

however much we may deplore the loss of time and labour devoted to the defence of untenable positions, it must be conceded, that they displayed far less polemic bitterness than certain writers who followed them ‘beyond the Alps,’ two centuries and a half later.²⁵

Although Lyell’s anxiety to avoid religious controversy is well-disguised in *Principles* and all references to Mosaic Revelation are kept to a minimum, it comes out all the clearer in his correspondence following the publication of the first volume of *Principles*. In a well-known letter Lyell asked Poulett Scrope, who was asked to review *Principles* in the *Quarterly Review*, to do what he himself could not do in his book: openly to draw from the facts the uniformitarian conclusions against the religious truth of the Mosaic account. He writes, “I am sure you may get into Q.R. what will free the science from Moses [...] I was afraid to point the moral, as much as you can do in Q.R., about Moses [...] If I have said more than some will like, yet I give you my word that full *half* of my history and comments was cut out, and even many facts.” “If we don’t irritate,” Lyell adds, “we shall carry all with us.”²⁶

Lyell was reminded of the hostility of the laity to new theories which involved a change in the traditional concept of the creation and providence. In a letter to his sister Eleanor he writes at this time about the reaction to Milman’s *History of the Jews*, a startling history for an ordained clergyman, who was “in danger of having his gown torn off” by his own parishioners.²⁷ Anxious on the one hand but confident in the “liberality and candour”²⁸ of the age on the other, he believes that, compared to Milman’s, his book will be “thought quite orthodox.” In the above-mentioned letter to Scrope, for example, he takes courage from Bishop Sumner’s review of Andrew Ure’s book in the *British Critic and Theological Review*, which he had condemned because of the “mischief and scandal brought on them by Mosaic systems.” Lyell insists,

²⁴ *Principles* i.24.

²⁵ *Principles* i.25.

²⁶ June 14, 1830, *LLL* i.268-71. Wilson quotes from a letter to his father of August 11, 1829: “I have gone over my first chapters & I think I have cut out all that any Bishop could object to,” (*Charles Lyell*, p.268).

²⁷ February 26, 1830, *LLL* i.263

²⁸ Letter to Scrope, June 14, 1830, *LLL* i.271; almost a year earlier he had written in a letter to Murchison (August 11, 1829) that John Fleming thought that “the age will not stand my anti-Mosaical conclusions” (quoted in Wilson, *Charles Lyell*, p.267).

echoing Hutton, that, after all, he is not writing on creational questions: “probably there was a beginning—it is a metaphysical question worthy a theologian—probably there will be an end.” However that may be, he argues, inquiry should not be impeded by a “refuge to a ‘beginning,’ which is all one with ‘another state of nature’.”

A prominent feature of Lyell’s history of geology is his dissociation from the seventeenth and eighteenth-century system builders, who were mainly theologians. He was not blind to the fact that his new principles of reasoning entailed a new system of the earth and its history. And as such it was recognized by Lyell’s reviewer William Whewell in *The British Critic*: although Whewell was impressed by Lyell’s vast body of evidence, he could not finally accept the theory of this system-builder which “must speedily fall back into the abyss of past fantasies and guesses from which he has evoked it in vain.”²⁹ But Lyell’s system is not cosmogony. Although the geologist’s concern is with past change, this does not imply the need to tell the story of the earth. On the contrary, Lyell emphasizes, by quoting Hutton, geology is not a science which studies the origins of the earth but only the changes of the earth’s crust.³⁰ If geology is not concerned with origins, it is also free from creational speculations in theological terms. Lyell cleverly illustrates how prejudices against proper geological thinking had arisen in the past from confusing it with cosmogony. Starting from Oriental cosmogony, he moves through the Egyptians and Greeks to the Arabian writers of the 10th century, and from the Italian Renaissance scholars to the late 18th-century theories of Hutton. He points to the fallacy of ascribing catastrophes changing the earth’s crust to the agency of God: “In a rude state of society, all great calamities are regarded by the people as judgments of God on the wickedness of man.”³¹ With this remark he seems again aware of how dangerously near he comes to Toulmin’s stance, and he continues almost apologetically that “a sketch of the progress of Geology is the history of a constant and violent struggle between new opinions and ancient doctrines, sanctioned by the implicit faith of many generations, and supposed to rest on scriptural authority.”³² Especially, when he comes to write of history still fresh in his readers’ minds, his tone becomes more soothing and leaning to sympathy, as in the following extract:

We cannot estimate the malevolence of such a persecution, by the pain which similar insinuations might now inflict; for although charges of infidelity and atheism must always be odious, they were injurious in the extreme at that

²⁹ Whewell, “Principles of Geology,” p.204.

³⁰ “The identification of its objects with those of Cosmogony has been the most common and serious source of confusion. The first who endeavoured to draw a clear line of demarcation between these distinct departments, was Hutton who declared that geology was in no ways concerned ‘with questions as to the origin of things’.” (*Principles* i.4)

³¹ *Principles* i.10.

³² *Principles* i.30.

moment of political excitement [1790s]: and it was better perhaps for a man's good reception in society, that his moral character should have been traduced, than that he should become a mark for these poisoned weapons.³³

And again, not knowing the quantity of time past, early geologists "could not, if they reasoned logically from such false premises, come to any other conclusion."³⁴ He, moreover, frankly admits that the immensity of time is one of the most difficult problems to come to terms with. The imagination staggers at the idea of time without beginning or end:

The imagination was first fatigued and overpowered by endeavouring to conceive the immensity of time required for the annihilation of whole continents by so insensible a process. Yet when the thoughts had wandered through these interminable periods, no resting-place was assigned in the remotest distance [...] Such views of the immensity of past time, like those unfolded by the Newtonian philosophy in regard to space, were too vast to awaken ideas of sublimity unmixed with a painful sense of our incapacity to conceive a plan of such infinite extent.³⁵

Yet, a right understanding of what seems infinite to the mind is essential for a truly scientific approach to geology. As short-lived terrestrial beings, man's observations of natural phenomena in time and space are limited. Our conclusions rest on phenomena observed during a few generations on land, whereas processes are often of extreme slowness. Our conclusions are, moreover, defective because four-fifths of geological phenomena escape us, as they take place in the oceans. Generalizations of a few centuries of terrestrial phenomena are, therefore, unreliable.

Lyell's uniformitarianism and the directionalists

As the historical sketch mainly serves to establish Lyell's own place in the history of geology, the rest of the first volume, and indeed the second, serve to establish the uniformitarian principles of reasoning in geology. In the first chapter Lyell had already clearly affirmed that Hutton's theory "will ultimately prevail." This is Lyell's aim. As such *Principles* are not descriptive geology, but a selection of examples to prove uniformity in nature. To Lyell, there was no evidence to suppose that former causes were different from actual ones:

Our estimate, indeed, of the value of all geological evidence, and the interest derived from the investigation of the earth's history, must depend entirely on the degree of confidence which we feel in regard to the permanency of the laws of nature. Their immutable constancy alone can enable us to reason from analogy, by the strict rules of induction, respecting the events of former ages, or, by a

³³ *Principles* i.69.

³⁴ *Principles* i.93.

³⁵ *Principles* i.63.

comparison of the state of things at two distinct geological epochs, to arrive at the knowledge of general principles in the economy of our terrestrial system.³⁶

Lyell's uniformitarianism advocates a steady-state system where processes are constant in kind and degree.³⁷ Even if most geologists by the 1830s were willing to accept a longer past for the earth and acknowledged the validity of the principle of actualism, uniformity of degree remained a stumbling block.³⁸ Geological evidence, however, seemed to indicate a past more violent and catastrophic than the present. It looked as if the earth was slowly moving towards a period of repose. As fossils of typically tropical animals and plants were found in northern Europe, it seemed indisputable that the climate of the earth was cooling down, and fossil series of increasingly sophisticated beings left little doubt of development. It all tallied perfectly with the widespread idea of improving progress in nature and argued powerfully for divine design and providence.

Lyell's uniformitarianism set out to combat this view. Adam Sedgwick rather skirted the importance of Lyell's geological theory in his Anniversary Address to the Geological Society of 18 February 1831. Lyell admitted years later that this approach hurt him deeply. What probably stung Lyell was that Sedgwick thought that he "began with *a priori* reasoning on any assumed uniformity of physical events."³⁹ William Whewell, however, shared Sedgwick's doubts about the validity of Lyell's principles. In his *Philosophy of the Inductive Sciences* he emphasizes that inductive scientists should reason from facts alone and not from any assumption that the course of nature is uniform. Why allow for infinite time and rule out infinite energy?

One can see why Sedgwick and Whewell thought Lyell reasoned *a priori*. Lyell admitted in a letter to Whewell:

The former intensity of the same or other terrestrial forces may be true; I never denied its possibility; but it is conjectural. I complained that in attempting to explain geological phenomena, *the bias* has always been on the wrong side; there has always been a disposition to reason *à priori* on the extraordinary violence and suddenness of changes, both in the organic crust of the earth, and in organic types, instead of attempting strenuously to frame theories in accordance with the ordinary operations of nature.⁴⁰

³⁶ *Principles* i.165; this was the idea Lyell set out with. While the ideas for his book were growing upon him, he wrote from Naples to Murchison that he wanted "to establish the *principle of reasoning* in the science," which is for Lyell, "that *no causes whatever* have from the earliest time to which we can look back, to the present, ever acted, but those *now acting*" (January 15, 1829, *LLL* i.234).

³⁷ Actualism explains former changes of the earth's surface by the same kind of forces which are now in operation; these are not necessarily of the same intensity. Cf. Rudwick, "The Strategy of Lyell's *Principles of Geology*," p.8.

³⁸ Cf. Hooykaas, *The Principle of Uniformity*, pp.32-7.

³⁹ Letter to W. Whewell, March 7, 1837, *LLL* ii.6

⁴⁰ To Whewell, March 7, 1837, *LLL* ii.3 (*italics mine*).

The weakness of Lyell's theory lies in the assumption ("bias") that uniformitarian reasoning is more philosophical than catastrophist thinking. Actually, they are both systematical approaches to explaining geological phenomena, and as such *a priori*. Whewell could rightly claim, therefore, that "catastrophes are just as probable as uniformity."⁴¹ Lyell's uniformitarian approach is valid as a "methodological principle," but should not be confounded with laws of uniformity.⁴²

Uniformitarianism was for Lyell, by definition (*a priori*) non-directional. To understand properly the controversial aspect of Lyell's uniformitarianism we should not underrate the importance of directionalist thinking in the history of English science. Directionalist thought had grown directly out of the eighteenth-century idea of the Chain of Being, a progressive system of classification of the natural world based on a linear series placing man and the animal, vegetable and mineral kingdoms in a hierarchical scale. Although originally conceived of (by Plato and Aristotle) as an eternal and immutable concept expressing the perfect rationality of the scheme of things, by the eighteenth century the idea was reinterpreted as the programme rather than the inventory of nature. Fossils had taught that the creation was not all perfection: some creatures in the scale had lived and disappeared. The principle, therefore, could be applied only to the universe in its entire temporal span: "While all the possibles demand realization, they are not accorded it all at once. Some have attained it in the past and have apparently since lost it; many are embodied in the kind of creatures which now exist; doubtless infinitely many more are destined to receive the gift of actual existence in the ages that are to come."⁴³

What Lyell often describes as religious preconceptions in geological thinking is little more than directionalist thinking. Directionalism enhanced geology with a kind of 'poetic mystery', whereas the 'actual cause doctrine' provided the geologist with tangible proof of processes which were leading to modern formations analogous to already existing formations.

In arguing for uniformitarianism Lyell had to contend against the evidence of the directionalist camp, which seemed backed by divine providence, and demonstrate that (1) climate is not directional (chapters VI - VII), (2) species are steady (chapter IX) and (3) destruction and reproduction balance each other (chapters X - XXVI). These three points are the core of Lyell's uniformitarianism. In explaining to Poulett Scrope, John Herschel and William Whewell his aim in writing *Principles*, Lyell emphasizes the importance to uniformitarian thinking of these three points and prides himself on their originality,⁴⁴ and he assures his readers that "the principles of the science must

⁴¹ *Philosophy* ii. 127.

⁴² Cf. Hooykaas, *The Principle of Uniformity*, pp. 38-42.

⁴³ See Lovejoy, *The Great Chain of Being*, p. 244.

⁴⁴ *LLL* i. 269, 468, ii. 5.

always remain unsettled so long as no fixed opinions are entertained on [these] fundamental question[s].”⁴⁵

The first point Lyell had to tackle was the evidence which had been brought forward since the earliest research on ancient strata, and more recently confirmed by the discoveries of the botanists, namely, that temperature had not been uniform in different geological eras. John Fleming, a Scottish Presbyterian minister who was probably the only geologist who carried uniformitarian principles further than Lyell, denied the evidence and adhered to a consistent system of uniformitarianism. It is easy to see why Fleming could not admit a gradual diminution of temperature, which, in principle, would have been directionalist. Lyell was not so dogmatic, however, and was scientific enough not to doubt the evidence of the fossil remains that the past climate of the higher latitudes of the northern hemisphere had been much warmer, and that the strata of different ages actually seemed to plead for a cooling tendency in the climate.⁴⁶

The dilemma, then, was how “such vicissitudes can be reconciled”—and ‘reconcile’ is indicative of Lyell’s method—“with the existing order of nature,” in other words, how to save uniformitarianism in the face of directionalist evidence. To argue from this evidence that the forces of the past were different from the present is premature, Lyell maintains, and testifies to a tendency in geology to avert apparent difficulties by resorting to different sets of powers in former worlds: “The cosmogonist has availed himself of this, as of every obscure problem in geology, to confirm his views concerning a period when the laws of the [...] world were wholly distinct from those now established.”⁴⁷

Often, when attacking directionalists, Lyell diverts the attention of the reader to the cosmogonist, subtly implying an identification between the two, which in reality did not exist. For example, Cuvier, the champion of catastrophism, was as suspicious of cosmogony as Lyell was. He praises the modern geologist as a man who “a préféré des richesses positives données par l’observation, à des systèmes fantastiques, à des conjectures contradictoires sur la première origine des globes et sur tous ces phénomènes, qui, ne ressemblant en rien à ceux de notre physique actuelle, ne pouvaient y trouver, pour leur explication, ni matériaux, ni pierre de touche.”⁴⁸ Most contemporary geologists, in fact, would agree with Lyell on cosmogony. But to Lyell a directionalist diminution of mean temperatures implied a belief in the theory that the earth was created in a state of fluidity and since then had been slowly cooling down.

⁴⁵ *Principles* i.144.

⁴⁶ *Principles* i.93; for a discussion of Lyell’s views of climate see Ospovat, “Lyell’s Theory of Climate.”

⁴⁷ *Principles* i.104.

⁴⁸ *Discours sur les révolutions de la surface du globe*, p.145.

Again, to Lyell, this was not philosophical, but an indulgence in framing “imagery systems for the government of infant worlds.”⁴⁹ Lyell’s geological principle explained past phenomena entirely in terms of present causes.

Thus, Lyell offers a new interpretation of the past changes of climate. Drawing heavily on the extended past of the earth, he supposes enormous, but gradual, fluctuations in the geography of the earth to have taken place (and implicitly these are still taking place), which result in ever different positions of land and sea. As an example, he points to submerged regions and tracts of land risen out of the sea that have taken place within a comparatively modern period in the Mediterranean area. Presupposing that huge masses of land have high mean summer temperatures and low mean winter temperatures, Lyell argues that, apart from latitude, climate is mainly determined by the distribution of land and sea between the poles and the equator. A large proportion of land near the poles results in a cooling down of mean temperatures, a large proportion of sea to a warmer climate. As a “repetition of an indefinite number of local revolutions” constantly modifies the proportion of land and sea near the equator and the poles, climate would accordingly change. This is not a directionalist principle but perfectly consistent with uniformitarian thinking, especially as the average quantity of land on earth would not be liable to change. Thus Lyell is able to turn the argument around:

We cannot help suspecting that if it had appeared that *the same species of animals and plants* had continued to inhabit the sea, lakes, and continents, before and after the great physical mutations which the northern hemisphere has undergone since the secondary strata were formed, the difficulty of explaining the ancient climate of the globe would have appeared far more insurmountable than at present.⁵⁰

The second persistent, and in the long run the most controversial idea of progression to combat was the progressive nature of species. Fossils seemed to indicate a perfectionist principle of nature from lower species to higher. Revelation confirmed this ascending system of the creation culminating in man. But progression implied a beginning, a beginning cosmogony. Again Lyell felt the need to dissociate himself from cosmogony. In an explanatory letter to Scrope, he writes that “it is the proof I deny, not the probability of a beginning [...] It is not the beginning I look for, but proofs of a *progressive* state of existence in the globe, the probability of which is *proved* by the analogy of changes in organic life.”⁵¹ Progression is not provable to Lyell, and true science can only be based on proved facts.

The choice of the word *progressive* is a bit unfortunate as it seems to imply progress from a less organized state to a more organized state. Lyell, however,

⁴⁹ *Principles* i.105.

⁵⁰ *Principles* i.142-3.

⁵¹ Letter to Poulett Scrope, June 14, 1830, *LLL* i.270.

meant 'successive' without progressive overtones. It is clear from his preliminary discussion of species and the recent appearance of man on earth (chapter IX) that evidence in support of progressive development of organic life is wholly inconclusive. He argues that the absence of fossil remains of higher animals is more likely the result of our imperfect fossil record; the fossil remains of mammalia or aves are necessarily rare as there is a lesser chance of them becoming imbedded in strata than animals living in the water. Moreover, looking over the sequences of fossils, one will always come across a few exceptions of a more progressive form of life amongst simpler forms, and "these exceptions are as fatal to the doctrine of successive development as if there were a thousand."⁵²

There is no doubt, however, of the recent origin of man. Man cannot be seen as the ultimate product of progressive development as he, with his faculties of morality and reason, is altogether a different form of life. Separate acts of creation are, therefore, indispensable to Lyell's way of thinking. There is no controversy with religion, nor with uniformitarianism. It actually reinforces his claims for uniformitarianism, and the idea of species still being created by the deity is implicit in the whole argument: "the rules followed by the Author of Nature in the creation and distribution of organic beings were the same formerly as now."⁵³ Here Lyell finds opportunity of quoting Paley and subscribing to the unity of the deity, thus placing his uniformitarian views firmly in the tradition of natural theology:

Of the "Unity of the Deity" the proof is the *uniformity* of plan observable in the universe [...] In our globe [...] new countries are continually discovered, but the old laws of nature are always found in them: new plants, perhaps, or animals, but always in company with plants and animals which we already know; and always possessing many of the same general properties. We never get amongst such original, or totally different, modes of existence as to indicate that we are come into the province of a different Creator, or under the direction of a different will. In truth, the same order of things attends us wherever we go.⁵⁴

Again, in his discussion of his third point to prove the principle of uniformity—the processes of decay and reproduction of the earth, which is by far the longest part of the first volume—Lyell fights the directionists. In his discussion of deltas, for example, he suddenly lashes out at Richard Kirwan and Jean André Deluc:

If speculations so vague and visionary can be proposed concerning natural operations now passing before our eyes—if authors may thus dogmatize, with impunity, on subjects capable of being determined with considerable degree of

⁵² *Principles* i.147.

⁵³ *Principles* i.146.

⁵⁴ Paley, *Natural Theology*, p.296. Lyell quotes this passage from "In our globe ..." onwards, *Principles* i.159.

precision, can we be surprised that they who reason on the more obscure phenomena of remote ages, should wander in a maze of error and inconsistency?⁵⁵

Lyell systematically divides the instruments of decay and reproduction in aqueous agents (the circulation of water from land to sea in the forms of rivers and springs, and the movement of water in lakes, seas and oceans) and igneous agents (volcanos and earthquakes). When Lyell prides himself, in the above mentioned letter to Scrope, that the division into aqueous and igneous causes is his, he forgets that Toulmin had used a similar division.⁵⁶

The purpose of these sections is to point out that renovating as well as destroying causes are constantly at work, and that through a long span of time they can work enormous change on the surface of the earth: "Although these agents, therefore, of decay and reproduction, are local in reference to periods of short duration, such as those which history in general embraces, they are nevertheless universal, if we extend our views to a sufficient lapse of ages."⁵⁷

On aqueous agents Lyell argues powerfully that apart from its obvious eroding powers, running water has great reproductive effects. He discusses in detail the delta-formation of the great European rivers as well as the oceanic deltas of the Ganges and the Mississippi. He concludes that these rivers are ample proof of how "constant an interchange of sea and land is taking place on the face of our globe."⁵⁸ It is interesting to note that in these descriptions he gives massive proof to support the climate theory with which he started his crusade against directionalist thinking.

In his next section (on igneous causes) he describes the most important eruptions based on his field experience in Italy, which is followed by a long catalogue of the most important earthquakes of the last 140 years, some of them extremely well-documented and describing in great detail the changes wrought on the relative level of the different parts of the continents.⁵⁹ He turns the catastrophic power of volcanoes against the catastrophists: the knowledge of the catastrophic events accompanying earthquakes must perforce shake the catastrophist's belief that "the earth has at length settled into a state of repose."⁶⁰

It is true that Lyell's uniformitarianism contests current cataclystic ideas, but this does not mean catastrophes as such do not happen. It is part of the "economy of nature" that they have their part in the shaping of the earth's crust. What Lyell denies is the proof that they were more intense in the past than they

⁵⁵ *Principles* i.224-5.

⁵⁶ *LLL* i.269.

⁵⁷ *Principles* i.257.

⁵⁸ *Principles* i.255.

⁵⁹ E.g. the earthquake in Calabria of 1783. This account follows mainly Sir William Hamilton observation published in the *Philosophical Transactions* of that year.

⁶⁰ *Principles* i.409. The core of catastrophist thinking is that the earth underwent a series of violent convulsions at its formation and that the earth is now in a state of repose.

are now. Catastrophes are, therefore—and with this he concludes his first volume—elements of stability in the system of nature; although “so often the source of death and terror to the inhabitants of the globe [... it] is, nevertheless, a conservative principle in the highest degree, and, above all others, essential to the stability of the system.”⁶¹

This brings out the slight difference between actualist and uniformitarian thinking, which is, in fact, not always clearly distinguished in Lyell’s writings. Catastrophists might well accept that former causes were the same as present causes, uniformitarians might include catastrophes as part of the steady-state system of nature. The dividing-line blurs, and the only point of disagreement is a question of intensity, not of kind. Lyell’s *Principles* were, therefore, less revolutionary than is often thought in retrospect.

Language, metaphor and the limits of the imagination

The immeasurability of past time confused many Victorians, who had been led to believe that the earth was created about 6,000 years ago. It disturbed the uninitiated in geology profoundly because it ran counter to revealed truth. But even for enlightened scientists, who had had to accept a longer vision of the earth’s past long before it became general knowledge, we often find emphasis on the staggering effect time has on the imagination; Hugh Macmillan as late as 1861 writes:

Life may have been ushered upon our globe through oceans of the lowest types of confervae, long previous to the deposit of the oldest palaeozoic rocks as known to us; and for myriads of ages these extremely simple and minute plants [such as mosses, lichens, algae] may have represented the only idea of life on earth [...] and gazing upon its dusky contents, our minds are baffled in aiming to comprehend the bulk of original material, the seasons of successive growth, and the immeasurable years or ages which passed.⁶²

This perplexity of the imagination brings in Lyell’s preoccupation with language.

Lyell’s task in writing *Principles* is also a work of decipherment:⁶³ the history of the earth’s crust is a “book [...] written in characters of the most striking and imposing kind,” “written, in legible characters;” “part of the ancient memorials of nature were written in a living language,” and “the characters imported thousands of years, and thousands of years where the language of Nature signified millions.”⁶⁴ To circumscribe the indefinite span

⁶¹ *Principles* i.479.

⁶² *Footnotes from the Book of Nature*, pp.4,5.

⁶³ See also Rudwick, “Transposed Concepts from the Human Sciences in the early Work of Charles Lyell,” pp. 67-83.

⁶⁴ *Principles* i.20,63,73,79.

of time, Lyell uses the metaphor of language to sustain the imagination in imagining this idea of time with the help of reading “the chronological series of Nature’s archives.”⁶⁵

As Gillian Beer has pointed out in discussing Lyell’s, as well as Darwin’s, “reading the evidence of time,” reading implies narrative.⁶⁶ And, after all, to some extent, Lyell is telling the story of the earth. Although he vehemently warns against the fallacy of creation-myths (cosmogony), he himself cannot entirely escape from telling his own version. This tendency, which can already be noted in Lyell’s historical sketch, is, in fact, present throughout *Principles*, and it is this quality which makes the work extremely readable. Actually, good story-telling is part of Lyell’s strategy. In the eleventh edition (1872), for example, we read a lively account, using animated dialogue, of Muhammad al-Qazwīnī’s narrative of an allegorical personage; another example of pure narrative is his presentation of Abraham Gottlob Werner, the founder of Neptunism. Lyell writes that

Werner had a great antipathy to the mechanical labour of writing, and he could never be persuaded to pen more than a few brief memoirs, and those containing no development of his general views. Although the natural modesty of his disposition was excessive, approaching even to timidity, he indulged in the most bold and sweeping generalisations, and he inspired all his scholars with a most implicit faith in his doctrines. Their admiration of his genius, and the feeling of gratitude and friendship which they all felt for him, were not undeserved.⁶⁷

Style and structure were of importance to Lyell. He sharply criticized, for example, Moro’s “extremely prolix” style and noted with pride that both Moro and Hutton stood in need of an illustrator.⁶⁸

A fluent and clear prose style helps to surmount the unimaginable and to convince the reader of the logic of a line of thought. This often results in a use of elaborate, sometimes fantastic, though always well-told, analogies. Towards the end of the seventh chapter, for example, Lyell studies the necessary influence on climate when the relative positions of the continents or parts of them are changed. In the preceding chapter he had already proved that “the earth’s surface has experienced great changes of climate,”⁶⁹ which changes he now continues to explain according to his principles of uniformitarianism, as, up to then, “the cosmogonist has availed himself of this, as of every obscure problem in geology, to confirm his views concerning a period when the laws of the animate and inanimate world were wholly distinct from those now established.”⁷⁰ After having explained his principles governing temperature

⁶⁵ *Principles*, Eleventh Edition (1872), i.94

⁶⁶ *Darwin’s Plots*, p. 44.

⁶⁷ *Principles* i.56.

⁶⁸ *Principles* i.43.

⁶⁹ *Principles* i.104

⁷⁰ *Principles* i.104

on earth, he amplifies his argument by proposing a hypothetical case. He starts very tentatively with a minor change of the earth's surface: "*thus, for example, if we suppose*, by a series of convulsions, a certain part of Greenland to become sea."⁷¹ In compensation he turns the sea between Lapland and Spitsbergen into a tract of land. This would have enormous consequences for the distribution of species, he argues, as parts of North America would become a little warmer, the north of Europe colder. The next step in his hypothetical case: "if all species were now, *by an exertion of creative power*, to be diffused uniformly throughout these zones,"⁷² they would soon depart from their original distribution and some would become locally extinct, as the earth is in perpetual change. The hypothetical case, which started merely as an example and needed an "exertion of creative power," next becomes a creative act itself. Ironically enough, Lyell uses the phraseology of Genesis when he pursues his example:

But *let* the configuration of the surface *be* still further varied, and *let* some large district [...] such as Mexico [...] *be* converted into sea, while lands of equal elevation and extent are transferred to the arctic circle [...] *let* the Himalaya mountains, with the whole of Hindostan, sink down [...] and then *let* an equal extent of territory and mountains, of the same vast height, stretch from North Greenland to the Orkney islands.⁷³

Lyell is near playing God here, and is clearly enjoying it. The continuation of this case a few pages later deserves full quotation:

We might first continue these geographical mutations, *until we had produced* as mild a climate in high latitudes as exists at those points in the same parallel where the mean annual heat is now greatest. *We should then endeavour to calculate what further alterations would be required to double the amount of change; and the great deviation of isothermal lines at present seems to authorize us to infer, that without an entire revolution of the surface, we might cause the mean temperature to vary to an extent to 20° or even 30° of latitude,—in other words, we might transfer the temperature of the torrid zone, to the mean parallel, and of the latter, to the arctic regions. By additional transpositions, therefore, of land and sea, we might bring about a still greater variation, so that, throughout the year, all signs of frost should disappear from the earth.*⁷⁴

The intervention has become a kind of personal act of creation at this point and it is difficult not to imagine the author moulding the earth with his own hands.⁷⁵ Effectual indeed, but an indulgence against which the author himself had

⁷¹ *Principles* i. 114; all italics here and in the following quotations are mine.

⁷² *Principles* i. 114

⁷³ *Principles* i. 117

⁷⁴ *Principles* i. 121-22

⁷⁵ Part of the interest of this example of speculation derives from the fact that Lyell did not reprint it in later editions. Thus, in the eleventh edition of 1872, instead of this colourful experiment, we find different hypothetical positions of land and sea graphically displayed while the text describes the results on climate of each example.

warned a few pages earlier.⁷⁶ It should caution us against Lyell's protestations of objective observation, and his *Principles* are, after all, an attempt to forge a new history of the globe not unlike his history of the science itself. He actually confides the pleasures of discovery to the reader and at one point admits that the work of the historian and geologist is, in fact, very like creating:

Our generalisations are yet imperfect [...] Meanwhile the charm of first discovery is our own; and, as we explore this magnificent field of enquiry, the sentiment of a great historian of our times may continually be present to our minds, that "he who calls what has vanished back again into being enjoys a bliss like that of creating."⁷⁷

Narrative is clearly an essential part of *Principles*. Apart from its strategic necessity, both as a control of his place in the history of geology and as an instrument in limiting the bewilderment of the mind before the immensity of the subject matter, Lyell, like Darwin in his *Origin* thirty years later, enjoys the urge of narration. A good example is found when Lyell is describing a picture by Bewick as an example of the inroads of the sea which are devastating and undermining cliffs on the British coast. It deserves quotation in full, as it is representative of the more playful and poetic side of the first volume of *Principles*:

On the verge of a cliff, which the sea has undermined, are represented the unshaken tower and western end of an abbey. The eastern aisle is gone, and the pillars of the cloister are soon to follow. The waves have almost isolated the promontory, and invaded the cemetery, where they have made sport with the mortal relics, and thrown up a skull upon the beach. In the foreground is seen a broken tombstone, erected, as its legend tells, "to *perpetuate* the memory" of one whose name is obliterated, as is that of the county for which he was "Custos Rotulorum." A cormorant is perched on the monument, defiling it, as if to remind some moralizer like Hamlet of "the base uses" to which things sacred may be turned. Had this excellent artist desired to satirize certain popular theories of geology, he might have inscribed the stone to the memory of some philosopher who taught "the permanency of existing continents" — "the era of repose" — "the impotence of modern causes."⁷⁸

Moreover, the section narrating the process of formation of the British coast,

⁷⁶ Lyell recognizes this to some extent when he is about to round off the argument of this chapter: "but, not to indulge these speculations farther, we may observe, in conclusion..." (*Principles* i.123).

⁷⁷ *Principles* i.74. The historian quoted by Lyell is B.G. Niebuhr. Gillian Beer quotes a similar pleasure of discovery and story-creating from Darwin's "Autobiographical Fragment, Written in 1838," (*Darwin's Plots*, p. 29).

⁷⁸ *Principles* i.273-4. Wilson quotes a similar example of Lyell's irony in the descriptive section (chapters X-XXVI) of geological phenomena. See also the description of the temple of Vesta, Tivoli, i.197. Wilson remarks that Lyell's "use of irony was infrequent and restrained" (*Charles Lyell*, p.280); This needs qualification as Lyell regularly inserts ironic, sometimes contemptuous comments in his descriptions to remind the reader that his massive evidence is not merely descriptive geology but serves as proof against the catastrophist principle of reasoning in the science; for some of the most obvious examples, see *Principles* i.172,224-4,245,261,338, 409,459.

of which the quotation above is part, is one of the liveliest parts of the first volume in terms of description, especially as Lyell shows that change of the coastline is so intimately bound up with the every-day life of people. Churches, houses, whole villages, of which only the names remain, have been washed away. Lyell must have recognized its impact on the reader, as he amplified these descriptions in subsequent editions, where he often recounts with epic grandeur the destruction and tragedy of the past.

On the one hand, Lyell limits his field of observation by using the metaphor of reading (implying narrative) consciously (the earth is the “theatre of decay”), on the other his style approaches at points narration itself. It is exactly this quality which goes a long way to explaining the impact and popularity of *Principles of Geology* throughout the nineteenth century. Lyell was above all a very skilful writer.

Professorship and the bishops

The publication of the first volume of the *Principles* marked a milestone for Lyell. He had expounded his uniformitarian ideas without any serious reactions against them in the field of religion or science. Lyell proudly records William Smith telling him of his “astonishment and admiration at your having, among other things, been the first to take the bull by the horns, about the antiquity of the earth, and contrived to do it in so inoffensive a way.”⁷⁹ Thus far Lyell had been successful. But, although his position in the scientific world of geology had been established, his financial future was not: the dilemma of a stable source of income pressed him sorely. He set his mind on the chair of Mineralogy and Geology at King’s College, founded in 1829 as a church institution to counteract the unchartered non-conformist University of London (later University College). The chair would give him a small income besides earning him lasting respectability. As Whewell had reviewed his book with respect in the orthodox *British Critic*, he had good hopes of obtaining the post.⁸⁰

The chair, however, did not exist right then, and Lyell asked Sedgwick to propose his name to the bishops who had the chair in their gift. Lyell often bitterly lamented the fate of the professional geologist who could not fall back on church preferment as a source of income, and he is often close to envy when writing about Buckland’s canonry. Many geologists held livings. Sir Robert Peel, who often dined with the eminent scientists of his day, and later Prince Albert (during Lord John Russell’s ministry) wanted to promote liberal minds

⁷⁹ Journal to Miss Horner, August 23, 1831, *LLL* i.326

⁸⁰ Cf. Wilson, *Charles Lyell*, p.308.

in the Anglican Church and appointed many scientists to high church offices.⁸¹ Lyell increasingly felt that scientists were entirely unprovided for and that science could not be pursued without private means. Years later, in 1856, he sums up his views and stresses that science is not served by church preferment.

Buckland, from the time he was preferred to a Deanery, held and neglected his Geology Chair at Oxford; [...] Sedgwick did the same at Cambridge, or was less efficient when resident Canon at Norwich; and worst of all [...] Henslow, whose influence when resident in the University was so great over the young men, no sooner became the conscientious pastor of an ignorant Suffolk flock, than three-fourths of his usefulness as Professor of Botany was at an end, and still he retains his chair!⁸²

His grumbling in this letter to John Fleming reminds us of his slightly melancholic, slightly envious expressions thirty-one years before at Buckland's appointment as Canon of Christchurch, Oxford,⁸³ exactly when Lyell had to choose between the bar or geology.

The appointment to the chair at King's College was entirely in the hands of five churchmen: Archbishop Howley of Canterbury, Bishop Blomfield of London, Bishop Copleston of Llandaff, Dr. D'Oyly and Dr. Lonsdale. Although they concluded that Lyell had not made his "theory from any hostile feeling towards revelation,"⁸⁴ Edward Copleston remained doubtful—and he had the right to veto the nomination. He wrote to Lockhart, editor of the *Quarterly*, that he did not "like to weaken the belief in a positive act of creation [...] nor again the belief in a universal deluge."⁸⁵ Lyell, to whom the letter had been passed on, answered the bishop that he did not want to "dispense with the direct intervention of the First Cause in the creation of species" nor doubts the "opinion generally entertained of the creation of man within the period generally assigned." Moreover, although there is abundant proof the flood could not have covered the whole earth, he has no evidence that "the whole inhabited earth [...] may not have been deluged within the last 3 or 4,000 years."⁸⁶ Leonard G. Wilson remarks that "one could wish that Lyell had not written this letter," but this is not to appreciate Lyell's position in his own terms.⁸⁷ Lyell did not compromise his scientific freedom here for the sake of obtaining the post of professor of King's College. In the first place,

⁸¹ Chadwick, *The Victorian Church*, i.229,235. See also Gordon, *Life and Correspondence of William Buckland*, pp.165-72.

⁸² February 6, 1856, *LLL* ii.208.

⁸³ "Buckland, you know, is made by Lord Liverpool a canon of Christ's Church, a good house, 1,000*l.* per annum, and no residence or duty required. Surely such places ought to be made also for lay geologists," (Letter to G. Mantell, July 20, 1825, *LLL* i.161).

⁸⁴ Letter to G. Mantell, March 16, 1831, *LLL* i.316-7.

⁸⁵ Copleston to J.G. Lockhart, March 18, 1831, Wilson, *Charles Lyell*, p.309; Coplestone was the author of a flattering review of Buckland's *Reliquiae Diluvianae* in the *Quarterly Review* for 1823.

⁸⁶ Letter to Copleston, March 28, 1831, Wilson, *Charles Lyell*, p.310.

⁸⁷ *Charles Lyell*, p.309.

his letters show that his interest in the position steadily slackened when *Principles* turned out to be a financial success.⁸⁸ Secondly, he answered Coplestone's reservations honestly enough, forestalling his general conclusion on the species question in the second volume of *Principles*, as well as a conclusion he explicitly reached in a digression in his third volume that he could allow for a belief in a deluge "with respect to that portion of it [the globe] which was then inhabited by man."⁸⁹

Coplestone's reply, however, infuriated Lyell. After stating he would never maintain "a belief contrary to the truth [... and] by no means wish[ed] to check free enquiry," Coplestone expresses his conviction that Lyell "would not wish to fill the situation [... if he] thought it likely that the effect of [his] physical dissertations would be unfriendly to Christianity."⁹⁰ This answer clearly implied for Lyell that geology had to submit to orthodoxy. However, Coplestone ("a keen judge of intellectual ability [...who] made a principle of taking the liberal line in most matters")⁹¹ was not entirely wrong in asserting that such doctrines "would put in jeopardy the faith of many," and his caution in "hastening on the change" before undeniable proof has been established is not as tortuously hypocritical as Wilson supposes. To the historian it indicates how much orthodoxy was wavering on the brink of uncertainty and how utterly unprepared the church was in countering a tendency in science to disclaim the literal truth of Revelation.

Lyell's resentment, on the other hand, is understandable enough too: "he [Coplestone] hopes I shall understand in accepting the Professorship that I am not to put the *inferences* from my facts but let others draw them!! What a capital assessor of the Holy Office would he have made."⁹² Of course, his professional aim was to free geology from Moses, but he nevertheless resented being stigmatized as a danger to Christianity. To Lyell, his geology was compatible with exalted notions of the Creator. When he finally got the professorship, he did not hesitate to conclude his second lecture (May 4th), by quoting Bishop Blomfield, that "it is impossible that true religion can be injured by the ascertainment and establishment of any fact;" besides, he actually ventured to affirm that no science "affords a greater number of illustrations of the power & wisdom exhibited in the creation than Geology." His caution too is typical: the science was still young and, therefore, before reaching absolute certainty, "many observations require verification & correction."⁹³ It is for this reason that science and Scripture should be kept apart as much as possible. It is only in this last point that he fundamentally differed from Coplestone.

⁸⁸ See *LLL* i.318,357,359.

⁸⁹ *Principles* iii.270.

⁹⁰ March 30, 1831, quoted in Wilson, *Charles Lyell*, pp.311-12.

⁹¹ Reardon, *Religious Thought in the Victorian Age*, p.43.

⁹² Letter to his sister Marianne, April 7, 1831, *LLL* i.318.

⁹³ Martin Rudwick, "Charles Lyell Speaks in the Lecture Theatre," pp.150-51.

In the meanwhile, the 1,500 copies of the first volume of *Principles* had sold out, and Lyell's publisher Murray was ready for the second volume. Its manuscript was ready in December 1831, but the book came out in January 1832, approximately one year after the first volume. The second volume contained more matter for controversy: the reality of species.

CHAPTER FOUR

PRINCIPLES OF GEOLOGY 1832-3: WORKING HARD AT NATURAL THEOLOGY

Scientific assumptions

At the beginning of the nineteenth century, Paris was the centre of international scientific research. It is not surprising, therefore, that it produced some of the finest natural philosophers of the day. Scientists of international fame, as, for example, the German aristocrat Alexander von Humboldt, settled in the prolific Paris environment. Their research in geology, zoology, botany, anatomy and conchology was essential for Lyell, who during his repeated visits to Paris came to know most of them personally—Humboldt, Cuvier, Prévost, Duvan, Brogniart, Deshayes, de Beaumont, to mention only a few. Moreover, all of them were somehow involved in geology.

The staff of the National Museum of Natural History produced the great systematists Georges Cuvier and Jean Baptiste Lamarck. Cuvier is usually considered the father of comparative anatomy, but, what was more important for Lyell, he had built a system of the sequences of fossils in the tertiary strata. Lamarck, at the same time, was classifying vertebrates, including extinct species. It was mainly these two scientists who greatly influenced Lyell when he started thinking about the species question. He met Cuvier back in 1823 during his first professional stay in Paris, and he read a translation of Lamarck's *Philosophie zoologique* (1809) four years later in 1827. We have already seen how eagerly Lyell read Lamarck's work and, although he was not prepared to accept Lamarck's theory, the idea of successive series of species haunted his mind. Unfortunately Lyell never met Lamarck, whose incipient blindness in 1819 led to the end of his scientific career a few years later.

Lamarck was originally a botanist who, rather late in life, was nominated Professor of Invertebrate Zoology by the French Republic, which set him working on his now famous work. In his studies on the change in the invertebrates, he hit upon the principle of transmutation of species, although he did not grasp the principle of natural selection and put too much emphasis on hereditary factors and will-power in the reaction to environmental demands. His publication of *Philosophie zoologique* caused a scandal. Nothing less than irreligiosity could have led to and would be the result of this theory. In England it was vilified as the work of an atheist and immediately linked to

revolution and immorality. The collection of shells at the British Museum, which was ordered on the Lamarckian system, was quickly reordered. The idea of evolution made the effort of creation look unacceptably base. The English reaction to the French Revolution had led the English back to conservative orthodox religion and the name Lamarck, French and atheist, soon became equated with blasphemy and godlessness.

When Lyell returned from Sicily in 1829 with his new ideas on geology, he stopped in Paris to compare shells and get some of his new views confirmed by some of the distinguished Paris geologists before returning to England. From his Italian tour Lyell had found that the proportion of fossils of still living species increased as he went southwards. It implied that there were distinct tertiary periods of different age. The geologist Desnoyer directed him to the conchologist Gérard Paul Deshayes. Deshayes, Lyell writes in a letter to Mantell, is “the Cuvier of tertiary shells” and seeing his ‘museum’, Lyell realized that his own collection of shells was a mere trifle.¹ He, therefore, offered Deshayes his newly collected Italian specimens for study if he would draw up a table of tertiary shells for him.² This was an enormous enterprise. Deshayes’ collection included about 3,000 tertiary and about 5,000 living species; the tables were to be based on Deshayes’ complete collection of 40,000 shells. This much material would allow Lyell to draw conclusions with a degree of certainty he could never hope to reach with his own collections.

Lyell returned to Paris in September 1830 and found Deshayes in financial straits. He offered to pay him, using the name of his publisher, for the still unfinished tables of tertiary shells, which he wanted to include in the next volume of *Principles*. The deal included a month of instruction in conchology. Studying shells with Deshayes, Lyell soon became aware of the problems attending the distinction between species and mere varieties of species.³

The concept of species was of the utmost importance for Lyell in determining the relative age and sequence of strata,⁴ and as fossils through time seemed to point so unequivocally to a progressive series of life throughout the earth’s history, they seemed to afford the natural scientist an essential key to the archives of the past. It is hardly surprising, therefore, that geology, botany and zoology at the time were not easily divisible as separate sciences.

The study of organic remains in the light of the new discoveries in

¹ *Principles* iii.xiii-xiv

² *LLL* i.247

³ “The amount of variation which ought to determine a species is, in cases where they approach near to each other, a question of the nicest discrimination, and requires a degree of judgment and tact that can hardly be possessed by different zoologists in exactly the same degree,” (*Principles* iii.51). The importance of Deshayes’ enormous collection was the advantage that all species would be recognized on the same principles by the same man; this uniformity of judgment, Lyell explains, could hardly be hoped for when using the results of different expert conchologists.

⁴ *Principles* iii.49

comparative anatomy and in conchology, rather than mere eighteenth-century investigation of the structure and mineral ingredients of rocks, was the first impulse to a more modern geological approach.⁵ Therefore, as fossil evidence was at the bottom of so much true geological reasoning, Lyell strongly felt that the species question had to be settled before starting on geology proper.⁶ But what started as a few chapters to be included in the second volume of his *Principles* soon grew into a separate treatise on organic change. The two volumes now became three.

In his first volume Lyell had already brought forward a rather summary view of the species question, but apart from denying successive development in the animal and vegetable world, he had not discussed how, when and where species were introduced. Lyell had not discussed Lamarck's theory, although his correspondence shows that it was constantly on his mind at this time. Much of this comes out in the second volume, but although it is true that Lyell immediately grasped the implications for man in the Lamarckian scheme, his scientific objections, firmly grounded in his own research on fossils, made alarm for the dignity of man at this early stage unnecessary.

Lamarck's theory needed virtually unlimited time, which Lyell's own research in Italy had shown him to be available. The discovery that Egyptian mummies were identical with living species convinced him, however, that the transmutation of old species into new ones presupposed a time-span which staggered even Lyell's imagination. He attacks the principle, in fact, where it seems most absurd to him: "it must have required a good time for Ourang-Outangs to become men on Lamarckian principles."⁷ Although he had serious doubts about the availability of the time needed for Lamarck's transmutation, his major objection to the theory at this time is more probably to be sought in the fact that it denied the reality of species. On the basis of the fossil remains Lyell was going to establish a way to measure the relative antiquity of strata. But if it were shown that species were not fixed, his division would be based on imaginary entities and thus be worth nothing. Therefore, before presenting his division of tertiary strata, he first had to settle whether species existed and "whether species come in all at a batch, or are always going out and coming in."⁸

⁵ *Principles* iii.17

⁶ "The geographical distribution of animals and plants, the real existence of species, their successive extinction [...] These topics we regard as constituting the alphabet and grammar of geology [...] they form the groundwork from which we must rise to the contemplation of more general questions," (*Principles* iii.7).

⁷ Letter to his sister Caroline, October 19, 1830, *LLL* i.308. It is interesting to note that when Darwin declared in the first edition of *The Origin* that variation useful in the struggle for existence "should sometimes occur in the course of thousands of generations," (p.130) critics were fast to seize on the unacceptable amount of time needed for the formation and dissemination of new species, even in terms of newly discovered geological time. Compare Eiseley, *Darwin's Century*, p. 190.

⁸ Letter to Poulett Scrope, October 8, 1830, *LLL* i.304

Lyell opens the second volume of *Principles*, as he did the first, with a quotation from *Illustrations of the Huttonian Theory*, which, facing the frontispiece, asserts that the animal kingdom, as well as the inorganic world, is subject to change, and that “it is not only the individual that perishes, but whole species.” This emphasis on extinction was central for Lyell’s *Principles*.

The first chapters are a detailed presentation of Lamarckian principles, followed by Lyell’s marshalling of facts which firmly refuted transmutation. Lamarck came to his idea of progressive development through the differences he observed in the successive generations of vertebrates, but he was not aware of, or purposely ignored, the evidence for the enormous amount of extinction documented by the rocks. He attributed change to the adaption of species to an inner tendency to improvement and to the demands of the environment, so that species never became extinct but simply changed into new species. This implied that species as such did not exist, that every existing form passed by minute shades in other forms. Lyell, however, had the fossiliferous evidence of mass extinction before him, confirmed by Cuvier, when he started thinking about the species question. It is not strange that Lyell followed the opinion of most scientists of repute in maintaining the reality of species, especially as it seemed to support his own principles in geology. Although he gives the reader first a fair resume of Lamarck’s theory, when he comes to the acquisition of new organs, which Lamarck attributed to “the efforts of internal sentiment,” “the influence of subtle fluids” and “acts of organization,” he cannot but dismiss these theories as “fictions [...] and other phantoms of the middle ages.”⁹

Lamarck saw his work in a context of natural theology which traced the wisdom of the Creator. Although he was easily condemned for unorthodox views, he was by no means an atheist. To Lyell, Lamarck’s religious point of view was perfectly acceptable, and he expressly writes he did not feel any *odium theologicum* towards the Frenchman. What Lamarck did was merely to change the scientific basis of the divine plan. Lyell, as we have seen, had his own ideas about a divine plan and did not fail to refer to the ‘Author of Nature’ and his ‘contrivances’ in *Principles*.¹⁰ Lyell’s objection to Lamarck’s transmutation was, at this stage, not on a religious plane, but was based on the unbridgeable gaps he perceived in Lamarck’s evidence. Lyell confidently defended the necessary fixity of species, allowing only for a limited capacity of variation within a species and for mutations of form being part of the permanent specific character. Beyond these minor capacities of change, some of which could be transmitted to offspring, no further deviation could be obtained. And as nature does not encourage intermixture of distinct species and as hybrids are rare and often result in sterility, it, therefore, appeared “that species have a real

⁹ *Principles* ii.8.

¹⁰ *Principles* i.146; ii.23,159; iii.384.

existence in nature, and that each was endowed, at the time of its creation, with the attributes and organization by which it is now distinguished.”¹¹

Although Lamarck became a true source of anxiety in the late 1850s for Lyell, in 1832 he was over-confident in repudiating the transmutation of species. He set himself in the first place to give an overall view of the dynamics of organic life and its interaction with non-organic matter as proof of the uniformitarian forces on earth. As such it turned into a comprehensive treatise of the present state of organic life, which starts with a study of the laws which regulate the geographical distinction of species. Lyell enumerates most ways of dispersion of species now in operation, from undigested seeds transported in the stomachs of birds, to animals transported on icebergs, to, finally, canoes with human beings drifting to vast distances. Geographical barriers were, according to Lyell, the key principle in explaining the present allocation of species. If climate alone, for example, were a decisive factor in the formation of a type through transmutation, then we would expect in places with the same climate the occurrence of the same species. But this was not the case. Naturalists had shown that the flora and fauna of Europe-Asia, America, and Australia, for example, were analogous but fundamentally different. This could only be attributed to geographical barriers which severely limited the possibilities of migration of species. Species, therefore, could not have been created in one geographical point and then, as Linnaeus maintained, have spread from there all over the world.

For the centre of creation Linnaeus had opted for a small tract of land surrounded by a universal ocean. Lyell asserts “that there never was a universal ocean since the planet was inhabited” and quotes the proof of the fossil remains of terrestrial plants in the oldest formations. This led Lyell, in his turn, to speculate on the original introduction of species:

Each species may have had its origin in a single pair, or individual, where an individual was sufficient, and species may have been created in succession at such times and in such places as to enable them to multiply and endure for an appointed period, and occupy an appointed space on the globe.¹²

Neither could species have been created all at the same moment by one act of creation. The fossil-record so clearly showed species coming into and going out of existence all the time that it could not be doubted that somehow new species were being created at various times. Again, transmutation could not be responsible for this, as a sudden change of environment would demand immediate adaptation of species, but, because transmutation is insensibly slow, species would become extinct long before they could adapt to these new circumstances.

¹¹ *Principles* ii.65

¹² *Principles* ii.124

Lyell could not but acknowledge the seemingly progressive element in the introduction of new species in general, but, he argues, it would be only natural to introduce the more primitive forms before the more developed forms as each species needed “time and opportunity to multiply before the species destined to prey upon it was admitted.”¹³ Lyell held this fact decisive in the question whether species existed or not:

It is idle to dispute about the abstract possibility of the conversion of one species into another, when there are known causes so much more active in their nature, which must always intervene and prevent the actual accomplishment of such conversion.¹⁴

One of those “known causes” is the principle he had found in De Candolle’s essay “Géographie botanique” that “all the plants of a given country are at war one with another,”¹⁵ which Lyell himself elaborates into a “universal struggle for existence”¹⁶ with clear implications of a survival of the strongest.¹⁷ He shows that there is a constant dynamic interaction between species, which determines their chances of survival.

Lyell did not discover anything new in his “struggle for existence.” Late eighteenth-century biological thinking was already thoroughly acquainted with the idea as a natural check on the prolific tendencies of procreation. As part of natural theology it is latent in Paley (“millions of other bodily forms and other species having perished, being by the defect of their constitution incapable of preservation,”)¹⁸ and overtly discussed by Joseph Townsend, a parson-geologist.¹⁹ It is clear that the concept had at this time very little to do with later evolutionary thought.

Although Lyell would not accept the transmutation of species, he is reluctant to commit himself to any explanation of *how* new species might have come into being; he stuck firmly to his motto that, after all, there are no traces of a beginning, no prospect of an end. This stand, however, was perfectly acceptable to most serious scientists. The great Cuvier held similar views that science and religion had to be kept strictly separate, and that it is fruitless for the scientist to speculate on beginnings for which he has no evidence.²⁰ Lyell’s final assertion, in fact, stresses that geologists have not enough material as yet to answer questions as to the origin of species. Lyell defends his non-commitment by emphasizing that, although it is very likely that species are still coming into being—as might be expected if uniformitarianism is a ruling

¹³ *Principles* ii.125

¹⁴ *Principles* ii.174-5

¹⁵ *Principles* ii.131

¹⁶ *Principles* ii.56

¹⁷ *Principles* ii.156

¹⁸ *Natural Theology*, p.42.

¹⁹ *A Dissertation on the Poor Laws*, 1786.

²⁰ See Rudwick, *The Meaning of Fossils*, p.120.

principle—it would be highly improbable actually to witness the introduction of a new species, because this would happen almost imperceptibly: “if only one of these [millions of species] were to become extinct annually, and one new one were to be every year called into being, more than a million of years would be required to bring about a complete revolution in organic life.”²¹

Religious assumptions

In 1832 Lyell writes to Miss Horner, his future wife, of the importance of religious consolation:

[in a case of death] the only state of mind in which a person of real feeling can find the least comfort is that of religious resignation. It matters comparatively little, as far as that consolation is concerned, how many erroneous dogmas and absurd rites are connected with the religion, provided its professors do not see through their fallacy.

He wonders, however, that so many enlightened minds do not see through the fallacy, that they can put reason blindly aside and reconcile themselves to the ceremonies of the Catholic Church. The argument seems to turn into the common Anglican objection to the superstitious qualities of the Roman Catholics, till Lyell suddenly admits that

if it were not, however, for the proneness of the people to superstition, and their [the Catholics'] gullibility, I should like a good deal of ceremonial. I like our English service so much better than the Scotch.²²

The sentiment expressed here is an essential part of the man Lyell; it can later be found in his veneration for the supposed relics of the Pilgrim Fathers in his travel journals of America some ten years later.

In the first volume of *Principles* Lyell had his quarrel with Moses. Once he had established his objections to the interference of Genesis with the facts of science, he could safely return to his basically deistic view of the plan of nature. The second and third volumes are the product of a writer who felt sure of his case, and are consequently less aggressive. Generally, a quiet religious strain can be traced in the later volumes. He does not insist, as he felt necessary in the first volume, on the superior qualities of man to separate him from the beasts. Man might be the crowning product of the creation, but to see evidence in this for transmutation is unwarranted:

The recent origin of man, and the absence of all signs of any rational being holding an analogous relation to former states of the animate world, affords one, and the only reasonable argument, in support of the hypothesis of a progressive

²¹ *Principles* ii.182

²² Journal to Miss Horner, April 21, 1832, *LLL* i.380

scheme, but none whatever in favour of the fancied evolution of one species out of another.²³

The implication of such writing is clear enough: Lyell is not disposed to discuss man's place in nature, as it is not questioned in the least. This position is supported by the recurrence of Paleyan concepts of deistic natural theology throughout the last two volumes.

At one point in the third volume, Lyell seems to re-open his quarrel with Moses, when he needs to discuss the impossibility of a universal flood and its supposed effects. Here he feels that Buckland had gone too far in interpreting geological evidence in terms of Genesis and links his name to Deluc. For a moment the reader is reminded of the criticism vented at the beginning of the first volume. Actually Lyell excuses himself that he has been led "with great reluctance into this digression," but that the geological evidence is completely incompatible with Mosaic cosmogony, that the latter is inconsistent in itself. His digression is necessary to remove "the groundless apprehension respecting the bearing of many of the views advocated in this work."²⁴ The apprehension is not specified in so many words but becomes clear in the tendency to natural theology in *Principles*. Behind his descriptions of the processes of the organic world there is always the presence of an Author of Nature, who, in order to maintain balance in the animal and vegetable kingdoms, may have "*created* [species] in succession at such times and in such places as to enable them to multiply and endure for an *appointed* period, and occupy an *appointed* space on the globe."²⁵ Although we must not generally attribute too much value to the verb "create", which was freely used in nineteenth-century natural philosophy for "originate", the word "appointed" unmistakably implies the existence of providence, of an underlying divine plan. But even "create" seems in Lyell to take on ambiguous dimensions. In the following, Lyell seems to opt for repeated intervention of the deity, whose creations are endowed with providence at the moment of creation:

We must suppose, that when the Author of Nature creates an animal or plant, all the possible circumstances in which its descendants are destined to live are foreseen, and that an organization is conferred upon it which will enable the species to perpetuate itself and survive under all varying circumstances to which it must inevitably be exposed.²⁶

Lyell does not leave the entire process of renewal of life to an abstract plan of providence, initially conceived and not further modified. Although there is a strong tendency to a purely deistic outlook, Lyell is never firm on this point.

On the whole Lyell's approach is very similar to Paley's. Lyell's Author of

²³ *Principles* ii.60.

²⁴ *Principles* iii.272.

²⁵ *Principles* ii.124 (emphasis mine).

²⁶ *Principles* ii.23.

Nature has not the genial personality of Paley's watchmaker but nevertheless shares the qualities of a similar presiding mind:

If, therefore, the Author of Nature had not been prodigal of those numerous contrivances before alluded to [...] if he had not ordained that the fluctuations of the animate and inanimate creation should be in perfect harmony with each other, it is evident that considerable spaces [...] would soon be devoid [...] of life.²⁷

The mechanism of the watch is not entirely different from Lyell's harmonious uniformity of the working processes of the earth. Passages like these are a perfect illustration of the link between eighteenth and nineteenth-century natural theology, which runs from Paley, through the Bridgewater Treatises, to an extreme form in Chambers' *Vestiges of Creation*.

Although Lyell is generally free from overtly religious intrusions, one cannot help often noticing the strong resemblance to Paley's reiterated emphasis on the perfection of the divine organisation. Lyell, for example, found support for his theory of repeated creations of species in Paley's repudiation of the hypothesis that the perishing of species supports the idea that forms of life now existing are the relics of what "the lapse of infinite ages has brought into existence:"

The distribution and sub-distribution of each into genera and species, which distribution is not an arbitrary act of the mind, but founded in the order which prevails in external nature, appear to me to contradict the supposition of the present world being the remains of an indefinite variety of existences.²⁸

And the concluding remarks of *Principles* at the end of the third volume—and the position is indeed conspicuous!—are significant in this respect. Compare them for example with the following quotation from Paley's *Natural Theology*:

In whatever direction we pursue our researches, whether in time or space, we discover everywhere the clear proofs of a Creative Intelligence, and of His foresight, wisdom, and power.²⁹

Whenever we find a general plan pursued, yet with such variations in it, as are, in each case, required by the particular exigency of the subject to which it is applied, we possess, in such a plan and such adaptation, the strongest evidence that can be afforded of intelligence and design.³⁰

The strong influence of natural theology in Lyell's approach is further illustrated by a passage written in 1832 to his future wife, where he explains how, in his second lecture at King's College, he

worked hard upon the subject of the connection of geology and natural theology,

²⁷ *Principles* ii.159.

²⁸ *Natural Theology*, p.43.

²⁹ *Principles* iii.384.

³⁰ *Natural Theology*, p.139.

and pointed out that the system which does not find traces of a beginning, like the physical astronomer, whose finest telescope only discovers myriads of other worlds, is the most sublime; and as there is no termination to the view as regards space of the acts of creation, and manifestations of divine power, so in regard to time.³¹

Lyell's uniformitarianism is clearly set off against a background of natural theology. Lyell's nomination as professor of geology at King's College could hardly have taken place without this presupposition.

³¹ Journal to Miss Horner, May 1832, *LLL* i.380.

CHAPTER FIVE

MODIFIED MUD OR MODIFIED MONKEY: UNIFORMITY, PROGRESSION AND TRANSMUTATION

There is more than a quarter of a century between the publication of Lyell's *Principles* and Darwin's *Origin of Species*, a period during which Lyell continued travelling, geologizing, and revising *Principles*, which went through nine editions during these decades. Lyell soon realized that much of the descriptive geology of his original third volume had better be presented in a separate book, which was needed as a more traditional kind of 'textbook'.¹ It was published in one volume by Murray as *Elements of Geology* in 1838, which likewise was regularly revised in the six editions through which it ran in the 27 years following publication. Lyell's revising of *Principles* and *Elements* turned out to be an affair that kept him busy for the rest of his life.

Historians of science initially stressed the similarities between Lyell's and Darwin's thinking, and then, seeing where Lyell's biological system tended, marvelled that he did not reach the conclusions Darwin reached. Thus Loren Eiseley writes: "One can scarcely resist the observation that *The Origin* could almost literally have been written out of Lyell's book."² The fact was tentatively explained by Lyell's emphasis on uniformitarianism, which was probably too rigidly applied by Lyell to counteract the directionalists. Early historians were further puzzled when Lyell remained reluctant to accept evolution even when it was made public in 1859, especially as his letters to Darwin reveal an emotional rather than scientific reluctance.

Most later critics of the 1970s, following Hooykaas's important study of uniformity, tend to play the importance of Lyell's emotional thinking down by stressing his philosophical reasons in maintaining strict uniformity against evolution. This view is illustrated by W. Faye Cannon in a paper read at the Charles Lyell Centenary Symposium in 1975. He writes that studies of Lyell's psychology are valid as studies of Lyell's religious position in Victorian society but relatively immaterial in interpreting his scientific stand against progression and transmutation: "Lyell must have had professional reasons for believing that his defense was good science; and his opponents must have thought so too,

¹ Gould maintains that Lyell defeated his strategy in moving the third volume of *Principles* to a different work and that Lyell's reworking his material for further editions similarly weakened the argument: "[Lyell] shifted and tinkered [in later editions of *Principles*] with so many chapters that the original coherence of argument dissipated," (*Time's Arrow, Time's Cycle*, pp. 143, 146, 149, 150).

² *Darwin's Century*, p. 100.

or they would not have bothered to argue at length with him.”³ This view seems to have gathered ground.

Michael Bartholomew, however, makes a case for Lyell’s emotional response and argues that “the implications of progression could not be squared with his deepest beliefs about man and God.”⁴ He admits that although the information we have about Lyell’s personal life is meagre, it still allows us to recognize a line of deistic thinking from his earliest publications onward. Lyell clearly saw his work as part of the tradition of natural theology, and as such confirming the perfect unity of design of the Creator. This, I have tried to argue in the preceding chapters, is the underlying proposition in Lyell’s scientific philosophy. Bartholomew attributes great significance to Lyell’s reaction in 1866 when W.B. Carpenter in a lecture on the antiquity of man accused the clergy of deliberate resistance to scientific theories. Lyell wrote to Huxley and Carpenter that he resented such a needless assault on the sentiments of the public, and he threatened to withdraw his contribution to the lectures. Indeed, this reaction is in line with my interpretation of Lyell’s outburst against Toulmin forty years before.

Without necessitating a rejection of explanations which see Lyell’s conservatism with regard to the acceptance of evolution as a logical outcome of Lyell’s uniformitarian stand, Bartholomew’s view seems sound. It is my purpose in the following to show that Lyell’s reactions to evolution in the years between *Principles* and *The Origin* are also emotionally charged. I will reserve a discussion of Lyell’s more strictly religious beliefs for a separate chapter.

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The quarter of a century between Lyell’s *Principles* and Darwin’s *Origin* is the period of a slowly but steadily growing theory of evolution, which in the first place became possible because of Lyell’s interpretation of geological time. The first two decades, however, are mainly untroubled years for Lyell’s view of species; it is in the years immediately preceding and following 1859 that his views are obfuscated and full of misgiving.

In the early thirties Darwin was still busily collecting material around the world as a naturalist on board the *Beagle*, very much after the fashion of the famous traveller-naturalist Alexander von Humboldt, and rumours reached England, through Henslow, about the immense wealth of material he was to bring back. Lyell and other naturalists impatiently awaited his return,⁵ which eventually took place in October 1836. A friendship which watered down after

³“Charles Lyell, Radical Actualism, and Theory,” p. 105.

⁴“Lyell and Evolution,” p. 265.

⁵“How I long for a return of Darwin!” (Letter to Sedgwick, December 6, 1835, *LLL* i.460-1).

1859 sprang up almost immediately after Darwin's landing in England. Darwin put all his faith in uniformitarianism and supported Lyell's theory with new revelations on the uplift and sinking of continents. They were congenial geologists, and this initially resulted in scientific collaboration. Darwin always generously acknowledged Lyell's influence on his discoveries and felt evidently grateful for his friendship.

But Lyell had no clear idea as yet what his *Principles* had done to Darwin's thinking.⁶ In July 1835 Darwin writes in a letter to W.D. Fox, that he had "become a zealous disciple of Mr Lyell's views" but that he is "tempted to carry parts to a greater extent even than he does."⁷

Lyell, in the second volume of *Principles*, had forcefully repudiated Lamarckian transmutation, but had not explicitly equated repeated creations to repeated interventions of the deity and left space, he thought, for speculation on this point. In an important letter to John W. Herschel, he admitted: "In regard to the origination of new species, I am very glad to find that you think it probable that it may be carried on through the intervention of intermediate causes. I left this rather to be inferred, not thinking it worth while to offend a certain class of persons by embodying in words what would only be a speculation."⁸ What Lyell had in mind as "intermediate causes" is hard to define; there was not much choice apart from transmutation or miraculous intervention. Refuting the former led to acceptance of the latter, as Lyell's German critics clearly saw: "The German critics have attacked me vigorously, saying that by the impugning of the doctrine of spontaneous generation, and substituting nothing in its place, I have left them nothing but the direct and miraculous intervention of the First Cause."⁹

What Lyell was probably aiming at was a perfect system of divine providence, which would square perfectly with his approach to geology in general. His idea of successively introduced species could only be accepted if one allowed for a supreme foreknowledge on the part of the Creator of all the different and ever-changing conditions of the physical world:

The idea struck me as the grandest which I had ever conceived, so far as regards the attributes of the Presiding Mind. For one can in imagination summon before us a small part at least of the circumstances that must be contemplated and foreknown, before it can be decided what powers and qualities a new species must have in order to enable it to endure for a given time, and to play its part in due relation to all other beings destined to coexist with it, before it dies out. It might be necessary, perhaps, to be able to know the number by which each species would be represented in a given region 10,000 years hence.¹⁰

⁶ Eiseley writes that Lyell is "the single greatest influence in the life of Charles Darwin," (*Darwin's Century*, p.98).

⁷ *Life and Letters of Charles Darwin*, i.263.

⁸ June 1, 1836, LLL i.467.

⁹ LLL i.467.

¹⁰ LLL i.468.

This glorification of God's omniscience emphasizes that Lyell's basic outlook is conditioned by natural theology. It leaves the meaning of intermediate causes obscure, however. This seems to indicate that Lyell did not know, and, moreover, that he did not consider it the task of the geologist to investigate into the origin of things. Lyell's only pronouncement is that, as everything in the past of the inorganic world can be demonstrated by present processes, phenomena in the organic world must also still occur:

The burden of proof rests on him who ventures to affirm that Nature has, at length, stopped short in her operations, and that while the causes of destruction are in full activity, even where man cannot interfere, she has suspended her powers of repair and renovation.¹¹

Repeated creation of species, therefore, is entirely consistent with Lyell's system.¹²

Lyell denied Lamarck's transmutation without dogmatically laying down miraculous intervention, leaving space for unspecified secondary causes. He writes that "the observations of naturalists may [...] accumulate positive data, from which an insight into *the laws which govern* this [organic] part of our terrestrial system may be derived."¹³ Thus, Darwin found space in Lyell's system for the principle of natural selection. He could not comply with Lyell's fixity of species, but otherwise left the latter's uniformitarianism untarnished.

Part of Lyell's reluctance to evolution must be attributed to his failure to grasp the difference between Darwin's evolution and Lamarck's transmutation, so that even after 1859 he kept referring to Darwin's theory as a theory of transmutation. Moreover, when in 1832 Lyell took a firm stand against both Biblical progressionists and Lamarckian transmutationalists, he was exceptionally perceptive that the evidence of the former, once accepted, would equally, if not better, serve the latter. Lyell, in fact, maintained that he could not see how one could scientifically support progression without "going the whole ourang." Progression ran contrary to the uniformitarian principle of kind as its creative forces were supposed to belong solely to the past, having completed its creative line. But—and Lyell was to develop this powerfully in later years—its basis was scientifically unsound, as the fossil record on which it was based was incomplete and, Lyell thought, actually disproved it. This applied equally to transmutation.

All these objections seem to support Lyell in his personal resistance to the unwarranted lowering of man's moral and intellectual dignity in the scheme of creation. It is true that Lyell defends his case with all his persuasive force

¹¹ Letter to Adam Sedgwick, January 20, 1838, *LLL* ii.37.

¹² "[we do not] doubt that if very considerable periods of equal duration could be taken into consideration and compared one with another, the rate of change in the living, as well as in the inorganic world, would be nearly uniform," (*Principles* ii.161).

¹³ *Principles*, ii.183 (my emphasis).

and presents a tight system of nature which did not allow for evolution, but an interpretation of his reluctance to accept transmutation should not unduly ignore his private views. From his earliest publications till the end of his life he increasingly cried out against the idea that man could be related so closely to the brute creation. Although Lyell's *Principles* are at war with the Mosaic account of the creation and his principle of repeated introduction of non-progressive creations openly disputed the evidence which enhanced Genesis with a sense of verity—championed by such prestigious scientists as Sedgwick or Whewell and forcibly brought before the general public by Hugh Miller with his *Footprints of the Creator* (1847)—yet his system should still be seen as profoundly religious in purpose, showing the wisdom and power of the Creator. And this is what he set out to consolidate till Darwin's views in the late 1850s profoundly confused and disturbed him.

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The fixity of species, which Lyell thought he had settled once and for all in the second volume of *Principles* was soon challenged again. In 1837 the Copenhagen conchologist Heinrich Beck's observations did not exactly agree with Deshayes' definitions, on which Lyell's principles rested, and Darwin started expressing his doubts about the fixity of species. Lyell rushed to Denmark to discuss species in person with Beck but came away assured there was no harm: he writes to Sedgwick in January 1838 that "the substitution of species to supply the vacancies, which must always be occurring, has also been going on; though *how*, is a point we are as ignorant of as of the manner of God's creating the first man."¹⁴ Accepting the divine in species creation, Lyell remains agnostic as to the manner of introduction of life in the system.

Although the species question precipitated during the 1840s, Lyell was not as yet particularly shaken in his convictions. In 1842 Darwin stated his ideas of species and the mechanism of natural selection in his first evolutionary essay, which was enlarged in 1844. Neither version was published, but Joseph Hooker was asked to read it and Lyell was probably acquainted with its contents.¹⁵ Moreover, 1844 was an especially stormy year in evolutionary thinking as it also saw the anonymous publication of *Vestiges of Creation*. Its amateur writer grasped in outline the mechanism of evolution and dispensed altogether with the fixity of species and the direct intervention of the Creator.

¹⁴ January 20, 1838, *LLL* ii.36

¹⁵ "Part of the MS. of his projected work was read to Dr. Hooker as early as 1844 and some of the principal results were communicated to me on several occasions," *Antiquity of Man*, p.319. The year 1844 is a little early, seeing that Darwin and Hooker had just met; it was not until 1856, however, that Lyell for the first time "heard the entire range of Darwin's ideas," (Browne, *Charles Darwin: Voyaging*, p.541).

Although the work contained numerous errors and fallacies, and was, therefore, easily criticized and slandered in the press, its popularity made evolution public property.

Lyell responded publicly, although cursorily, to the anonymous author of *Vestiges* in his Anniversary Address of 1851 as President of the Geological Society of London.¹⁶ The views of this “popular theory, or rather hypothesis” of transmutation is not really worth repeating, Lyell writes, as he had “uniformly opposed [them], for twenty years,”

and the favour which they have acquired of late, with the general public, in consequence of the eloquent pleading of the anonymous author of the “*Vestiges of Creation*”, has been more than counterbalanced by the refutation which it has called forth in the writings of Owen, Sedgwick, and Hugh Miller.¹⁷

Although Sedgwick, Owen, and Miller refuted transmutation, Lyell proceeds, strangely enough they embrace the doctrine of successive and progressive development in the plan of the creation, which, if the palaeontological evidence against transmutation is accepted, must be refused on the same grounds. Although the general impression of the fossil record seemed to imply progress, its few exceptions showed that this kind of reasoning could be highly fallacious. He warns the geologist again that the presence of a single specimen of a mammal in the Stonesfield oolite invalidated the theory and that “such a fact should for ever warn us against reasoning in future on mere negative evidence.”¹⁸ And he repeats with emphasis his principle of reasoning in geology as laid out in *Principles*: “If we infer the poverty of the flora or fauna of any given period of the past, from the small number of fossils occurring in ancient rocks, we are bound to remember that it has been evidently no part of the plan of Nature to hand down to us a complete or systematic record of the former history of the animate world.”¹⁹

Up to this point Lyell’s refutation of progressionist theory is written with all available palaeontological evidence at his disposal; it is presented with great authority on philosophical grounds of reasoning in science; it is given with the assurance of the established geologist who had seen his standard work through eight editions, and who had seen many of his theses slowly accepted by his fellow-geologists. The whole Address is offered to the Geological Society with confidence, based on a dazzling display of facts.

At the same time it betrays Lyell’s confidently deistic outlook—species are introduced by “the direct intervention of *the First Cause*, or by some unknown

¹⁶ Lyell, however, knew Robert Chambers to be the author. In a letter to his father, dated 25 June 1847, Lyell describes a meeting of the British Association, where Robert Chambers, “the author of *Vestiges*,” read a paper (*LLL* ii. 130).

¹⁷ “Anniversary Address of the President [of the Geological Society],” p. xxxiii.

¹⁸ “Anniversary Address,” p. lix.

¹⁹ “Anniversary Address,” p. lxxvii.

Second Cause or Law appointed by *the Author of Nature*.”²⁰ Lyell is not less confident about the status of man as evidence against the directionalists. Although man physically adheres to the universal design of the creation, his difference from the brutes is “one of kind rather than degree.” Lyell is still where he was twenty years earlier: even if progressive development were true from the sponge to the ape, “the creation of man would rather seem to have been the beginning of some new and different order of things [...] the intellect of man and his spiritual and moral nature are the highest works of creative power known to us in the universe.”²¹ In other words, the *dignity* of man excludes him from the progressive plan of the creation.

Chambers in 1851 was an easy opponent; with Sedgwick, Owen, and Miller, Lyell shared a final belief in providence. But from 1854-55 Darwin and Wallace started probing the reactions to their theories of evolution, and many of their points seemed unanswerable. Scientific circles were acquainted with Darwin’s “work on species” years before the actual publication of *The Origin*, and Lyell, as one of Darwin’s intimate friends, must have been informed about the latter’s growing theory. As early as 1854 Lyell wrote to Charles Bunbury about emerging conclusions about evolution “which will figure in C. Darwin’s book on ‘Species’, with many other ‘ugly facts’,”²² and eighteen months later he describes a dinner at Darwin’s house where Darwin, Huxley, Hooker and Wollaston “ran a tilt against species farther I believe than they are deliberately prepared to go.”²³ Lyell’s confidence in the fixity of species started wavering; he writes to Hooker in the same year to stress that the latter’s work “will be indispensable [...] seeing where we are drifting to; for whether Darwin persuades you and me to renounce our faith in species [...] or not, I foresee that many will go over to the indefinite modifiability doctrine.”²⁴

In 1855 Lyell started a series of notebooks, which he continued till the end of 1861. Rather than discussing Darwin’s views scientifically—the notebooks contain surprisingly little systematic argument—these notebooks reveal Lyell’s need to explore the implications of Darwin’s theory for his uniformitarian principles, but, above all, for his view of the dignity of man. These unique documents, found by Leonard G. Wilson in 1961 at Kinnordy House,²⁵ show the religious confusion of Lyell’s world view when progress in the organic world seemed scientifically irrefutable. The *Scientific Journals* confirm

²⁰ “Anniversary Address,” p.lxxiii (my emphasis).

²¹ “Anniversary Address,” pp.lxxiii,lxxv.

²² Letter to C.J.F. Bunbury, November 13, 1854, *LLL* ii.199

²³ Letter to C.J.F. Bunbury, April 30, 1856, *LLL* ii.212; contrary to what the wording suggests, Lyell was not present at this dinner and must have heard of the dinner second hand; see also Browne, *Charles Darwin: Voyaging*, p.538.

²⁴ Letter to Joseph Hooker, July, 25, 1856, *LLL* ii.214

²⁵ Published and annotated nine years later as *Sir Charles Lyell’s Scientific Journals on the Species Question*, ed. Leonard G. Wilson; henceforward *Scientific Journals*.

Lyell's basically teleological and anthropocentric precepts in science. The doubts that beset so many of his contemporaries in their attempts to evaluate evolution did not leave him untouched.

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Lyell's main preoccupation in the *Scientific Journals* is man's place in nature, which eventually lead to his third great book *The Antiquity of Man*, published in 1863. It is clear from the different entries of these six years of contemplation that Lyell's biggest problem rested with the dignity of man. Right at the beginning one of the entries reads that the introduction of man is a great disturbance and deviation in the plan of nature but that it is difficult to see this as a great development. Early on he examines man's rationality, moral faculty and his capacity for progress, and concludes that these qualities could by no means have evolved out of some anthropomorphous genus of a former world. The difference is of kind, not of degree, he reiterates.

As the *Scientific Journals* were not intended for publication, Lyell is often surprisingly frank in his struggle to come to terms with Darwin's ancestry for man. What seemed at stake was either Lyell's concept of the deity or his concept of honest science, and, ironically enough, in the end he found himself trying to reconcile religion and science.

Lyell clearly sees the danger into which the orthodox progressionists were running when they confidently proclaimed that progression in nature tended towards man, as the creation in Genesis led to the crowning creation of man:

When first the world began,
Young Nature thro' five cycles ran,
And in the sixth she moulded man.²⁶

But if we call man the last of a series of development from the fish to the apes, if we insist that man's intellectual and moral powers differ only in degree from them, we espouse a theory which is based on evidence which equally supports the transmutationist case, so that we cannot really speak of rival hypotheses.²⁷ Lyell sees with great clarity that if the progressionists do not accept that man is different in kind, they were digging their own graves in asserting that man's dignity consists in being the crowning operation of a progressive plan of the creation. The theory of Dana, Owen, Miller, Sedgwick, Agassiz "treads close upon Darwin & Lamarck's. It brings Man into the same system of progressive evolution on which developed the Orang out of an oyster."²⁸ Genesis leads straight to Darwinism.²⁹

²⁶ Alfred Tennyson, "The Two Voices."

²⁷ *Scientific Journals*, p.223.

²⁸ *Scientific Journals*, p.87.

²⁹ *Scientific Journals*, pp.88,98.

But the “successive appearance of higher and higher beings on the stage” seemed undeniable, even to Lyell, who often looked back wistfully to his thesis of the beginning of his career, and who, rereading *Principles*, still feels “the force of these arguments, none of which seem wholly answered & refuted.”³⁰ His approach is ambivalent. When he has read *The Origin*, he writes to its author:

I have just finished your volume [...] It is a splendid case of close reasoning and long sustained argument throughout so many pages [...] I have long seen most clearly that if any concession is made, all that you claim in your concluding pages will follow.³¹

As late as 1863, however, he admits to Joseph Hooker: “When I read again certain chapters of the ‘Principles,’ I am always in danger of shaking some of my confidence in the new doctrine.”³² This double approach is obvious throughout Lyell’s notes in his *Scientific Journals*.

Evolution brought him face to face with the status of man, not only in his own eyes but also in the Creator’s. If man is physically linked to the brute creation, can his soul elevate him from it? Man’s spiritual faculty seen as developed out of instinct is insupportable to Lyell. How much Lyell’s science was grounded on religiously anthropocentric principles becomes clear from a fragment of a letter written by Charlotte Brontë to James Taylor³³ February 11, 1851, which interested Lyell so much that he copied it out under the entry of February 9, 1857 in his third Scientific Journal.³⁴ Brontë’s feelings upon reading Harriet Martineau and Henry George Atkinson’s avowals of “atheism and materialism” in their *Letters on the Laws of Man’s Nature and Development* (1851) reflected Lyell’s fears that evolution seemed to undermine his fundamental belief in design. Brontë writes:

Sincerely, for my part, do I wish to find & know the Truth; but if this be Truth, well may she guard herself with mysteries, & cover herself with a veil. If this be Truth, man or woman who beholds her can but curse the day he or she was born.

Leonard G. Wilson, in editing Lyell’s *Scientific Journals*, finds it difficult to explain how Lyell could have had access to this letter. If the date of the entry is correct, this is indeed puzzling. The letter was reproduced in *The Life of Charlotte Brontë*, which its author, Elizabeth Gaskell, finished only two days

³⁰ *Scientific Journals* p.250; see also pp.55-6,87,250,278,288.

³¹ October, 3, 1859, *LLL* ii.325

³² March 9, 1863, *LLL* ii.361-2

³³ Professor Wilson considers William Thackeray as a possible correspondent. Charlotte Brontë’s correspondence, however, clearly points to James Taylor with whom she had been discussing Harriet Martineau’s forthcoming book in an earlier letter, dated January 15th, 1851. In the same letter she asks Taylor’s opinion of *The Leader*, for which she had been asked to contribute. She finishes the letter under discussion (February 11, 1851) by thanking him for his comment on this periodical. (See Wise and Symington, *The Brontës: Their Lives, Friendships & Correspondence*, iii.199-201,208).

³⁴ *Scientific Journals*, p.162.

before Lyell's entry, although it did not appear in print till March of that year.³⁵ As Lyell had no personal acquaintance with the Brontës or with the Gaskells, and as I can see no other possibility of how Lyell might have had an occasion to copy out this letter, other than from the published version in Gaskell's biography, it is probable that Lyell's entry is incorrect. Lyell was by no means consistent in dating all his entries, and it seems likely that Charlotte Brontë's letter comes as an undated entry, written by Lyell after reading it in *The Life of Charlotte Brontë*.³⁶

What is important, however, is what this letter tells us about Lyell, who must have been acquainted with Atkinson and Martineau's letters on *The Laws of Man's Nature and Development*,³⁷ widely seen at the time of publication as an avowal of atheism.³⁸ The two writers emphasize the folly of man in obscuring truth by adhering to an imaginary deity in whose likeness he is made. To Harriet Martineau it appears that "men come to the subject with antecedent notions of 'dignity of origin' for man; with words upon their lips about man being made in the image of God."³⁹ The result is a false approach to natural history, Atkinson agrees, which is only too readily interpreted in terms of human design:

We must not see ourselves reflected,—see the ghosts of ourselves in Nature, and imagine we recognize design, or a human origin of things. We must follow our great master Bacon, and make a stand against the fallacy of natural theology, and that exceedingly weak argument of Paley's about the watch, which only places the difficulty a little further off, and confounds the idea of creation with design or manufacture. To design is human.⁴⁰

Instead of supposing "eternal and inherent principles and laws of nature, evolving the sequence of events, and all the changes and forms of being, they [men] jump the mystery [...and] suppose a Creator after the likeness of Man." Both authors are savage in their attack on (natural) theology, and comparisons of religion with disease and insanity are rife: "All our hopes now lie in a true

³⁵ E. Gaskell to L. Wheelwright, February 7, 1857, *The Brontës*, iv.214; the biography was published by Smith, Elder & Co. on 25 March 1857 (Barker, *The Brontës*, pp.795-6).

³⁶ The entry of February 9, 1857 starts on page 48 of Scientific Journal III with an extract from a letter written by Joseph Hooker, which is continued on page 49. Charlotte Brontë's letter immediately follows Hooker's, but has not got anything to do with it logically. After Brontë's letter Lyell does proceed coherently. Brontë's letter, therefore, seems a separate, undated entry, which probably comes after March 1857 (ie. the publication of Gaskell's *Life*). My hypothesis is sustained by the fact that Lyell's next entry is July 11, 1858, which starts on page 74 of the Journal! It seems more reasonable to assume that all the intervening entries are undated, rather than that they all fall under February 9, 1857 and leave a gap of more than a year between these two entries.

³⁷ Lyell knew Harriet Martineau personally and was a visitor at her house (see Browne, *Charles Darwin: Voyaging*, p.377).

³⁸ See Bowen, *The Idea of the Victorian Church*, p.157.

³⁹ *Laws of Man's Nature*, p.11.

⁴⁰ *Laws of Man's Nature*, p.139.

understanding and philosophy of man's nature, when all theologies will be found to be the offspring principally of abnormal conditions or disease."⁴¹

Lyell, however, like many of his contemporaries, did care for the dignity of man. It is easy to see why Charlotte Brontë's pronouncement on the absolute quest for truth impressed him, as it definitely did: he refers to her again almost three years later in a dated entry for December 8, 1859, when he writes:

To imagine that our conception of the Deity will be lowered, that in his works we shall ever discover anything derogatory to the highest conception of his attributes might almost provoke a saint. But we may bring truths to light which may shake our confidence in some one of our articles of faith in which our estimate of the dignity of man is founded. We may feel inclined to say "if this be truth", etc.⁴²

To renounce his scientific quest for truth was as hard as to renounce his faith in a teleological world view. Years later, in 1863, he wrote to Darwin that he had spoken out to the utmost, but that "my feelings, however more than any thought about policy or expediency, prevent me from dogmatising as to the descent of man from the brutes, which, though I am prepared to accept it, takes away much of the charm from my speculations on the past relating to such matters."⁴³ Lyell had seen his role as scientist not independent from a confirmation of the orthodox attempts of showing the unity of, and the supremacy of man in, divine design, and now he saw this approach threatened.

Therefore Lyell sought to reach a kind of solution which both re-affirmed his strongly teleological world-view and satisfied his scientific mind.⁴⁴ Thus he partly accepts and partly refuses Darwin's hypothesis. Understandably, this stand was disappointing to Darwin.

Darwin still expected much from Lyell as one of his greatest supporters. Lyell's scientific opinion was important to Darwin in showing the world the soundness of his theory, as Lyell was still one of the greatest and most influential thinkers of the day. Much of his uniformitarianism had been accepted in geological circles and evolution, to Darwin and Huxley, seemed its logical result.

Lyell's long study of the place of man in the creation had led him to reconsider the antiquity of man. Although Lyell had spoken out clearly in his reassuring letter to Edward Copleston, Bishop of Llandaff, in 1831 that he had no doubts about the creation of man "within the period generally assigned,"⁴⁵

⁴¹ Atkinson to Martineau, *Laws of Man's Nature*, pp.171-2.

⁴² *Scientific Journals*, p.331.

⁴³ March 11, 1863, *LLL* ii.363-4

⁴⁴ Gould (*Time's Arrow, Time's Circle*, pp. 171-73) has argued that, when palaeontological progress seemed inevitable, Lyell chose evolution rather than orthodox progressionism to save his uniformitarianism as much as possible. He could thus maintain his principle of gradualism and leave most of his theory on the inorganic world unmodified.

⁴⁵ Letter to Copleston, March 28, 1831, quoted in Wilson, *Charles Lyell*, p.310.

proofs of human existence long before the biblical moment of creation were discussed in 1847 by Boucher de Perthes in his book *Antiquités Celtiques*. Lyell was impressed, visited the sites, and confirmed Boucher de Perthes' conclusions. Just before the publication of *The Origin* we notice a growing intensity in Lyell's interest in the age of man.⁴⁶ Various other human remains of pre-historic periods had been found in the meantime, and Lyell started compiling all the evidence of man's age, which ultimately resulted in the publication of *The Antiquity of Man*.

The Antiquity of Man was Lyell's first major publication after Darwin's *Origin*. The latest edition of the *Principles*—the ninth—dated as far back as 1853, and the next edition came out as late as 1866. This long silence—and there are not similar silences between previous editions—seems to point to a struggle in coming to terms with evolution.⁴⁷ (Once Lyell had made up his mind, new editions came out in his former rhythm.) Meanwhile, the scientific world waited eagerly for the master's verdict. It came in the *Antiquity* in February 1863 and quickly ran through three editions during the same year to become Lyell's second classic after *Principles*.⁴⁸ The book disappointed Darwin, however, who had expected Lyell to speak out more for evolution. In the chapter "On the Origin of Species by Variation and Natural Selection" Lyell enumerates "briefly some of the principal classes of phenomena on which the theory of 'natural selection' would throw light."⁴⁹ Later he speaks of "one of the most original *speculations* in Mr. Darwin's work."⁵⁰ Careful in his wording, Lyell does accept the principle of natural selection in plants and animals, but when it comes to discussing man's place in the creation, he cannot deny the possibility, or even likeliness, of divine intervention. The introduction of man's spirituality into the economy of nature remained a unique event:

There must have been a beginning to the series of such rare and anomalous events. If, in conformity with the theory of progression, we believe mankind to have risen slowly from a rude and humble starting point, such leaps may have successfully introduced not only higher and higher forms and grades of intellect, but at a much remoter period may have cleared at one bound the space which separated the highest stage of the unprogressive intelligence of the inferior animals from the first and lowest form of improvable reason manifested by Man.

To say that such leaps constitute no interruption to the ordinary course of nature is more than we are warranted in affirming [...] Still a mighty mystery remains unexplained, and it is the *order* of the phenomena. and not their *cause*, which we are able to refer to the usual course of nature.⁵¹

⁴⁶ *LLL* ii.319,324,330.

⁴⁷ Witness the years of publication of the first 10 editions: 1830-1832-1834-1835-1837-1840-1847-1850-1853-1866; the seven-year gap between the sixth and seventh editions is explained by Lyell's trips to America in 1841-2 and 1845-6.

⁴⁸ The book has actually been printed down into our century as an *Everyman* classic.

⁴⁹ *Antiquity*, p.322 (italics mine).

⁵⁰ *Antiquity*, p.324 (italics mine).

⁵¹ *Antiquity*, pp.392-3.

In an apologetic letter to Hooker, Lyell defends himself by saying that he did go beyond his “state of *feeling* as to man’s unbroken descent from the brutes” and went “farther in my reasoning towards transmutation than in my sentiments and imagination.” He feels that Darwin and Huxley “deify secondary causes too much.”⁵² The effect of his continued rereading of *Principles* is occasionally revealed in the *Antiquity of Man* when Lyell tries to reconcile his initial thoughts on species with natural selection. He writes, for example, in a labourious and slightly obscure sentence:

When I formerly advocated the doctrine that species were primordial creations and not derivative, I endeavoured to explain the manner of their geographical distribution, and the affinity of living forms to the fossil types nearest akin to them in the tertiary strata of the same part of the globe, by supposing that the creative power, which originally adapts certain types to aquatic and others to terrestrial conditions, has at successive geological epochs introduced new forms best suited to each area and climate, so as to fill the places of those which may have died out.⁵³

Here he painfully tries to minimize the gap between his *Principles* and Darwin’s *Origin*, explaining evolution through a rather ambiguous concept of ‘creative force’. He still uses the term *Author of Nature* as denoting personality which wills.⁵⁴

To Darwin himself, Lyell wrote that his “feelings [...] prevent me from dogmatising as to the descent of man from the brutes.”⁵⁵ Clearly the ‘feelings’ of the man could not be separated from the scientist. This more subjective side of Lyell’s character is well illustrated by a short passage in his *Second Visit* on the numerous relics, supposedly brought over in the Mayflower, on show in various parts of America. In his letters from his trip in Italy in 1828–29 he had often written disdainfully of the superstitious relics of the Roman Catholics. But when he realizes that most of the furniture attributed to the Pilgrim Fathers could not possibly have been brought over in a vessel of 180 tons, he admits that for a moment half his “romance about the pilgrim relics was dispelled,” but that, after all, he is not willing to give up his veneration for them nor the idea that some could be true and genuine relics.⁵⁶

This kind of instinctive veneration is reflected in his approach to man, which could not be explained in purely scientific terms. Therefore only compromise could lead him to embrace evolution. As long as he was convinced of the existence of a God-inspired soul, no real dichotomy existed: “the doctrine of the identity of the Human & the brute stock is only lowering to those who believe in the cessation of individuality after death [...] we shall continue

⁵² March 9, 1863 *LLL* ii.361.

⁵³ *Antiquity*, p.329.

⁵⁴ *Antiquity*, p.330.

⁵⁵ March 11, 1863 *LLL* ii.363–4.

⁵⁶ *Second Visit* i.120.

as much as ever to believe that we are not ephemeral creatures if we can think so now.”⁵⁷ Moreover, truth could not possibly be against God. Therefore, in our present moment of doubt and confusion,

there is only one great resource to fall back upon, a reliance that all is for the best, trust in God, a belief that truth is the highest aim, that if it destroys some idols it is better that they should disappear, that the intelligent ruler of the universe has given us this great volume as a privilege, that its interpretation is elevating, that if in deciphering records relating to many millions, perhaps millions of millions of past ages, we discover much that is irreconcilable with all the popular creeds which exist now, and all that have ever existed, it is no sign of our being false interpreters for it will not shake what has been common to the greater number of faiths in all ages & among all races, a belief in the Unity of the system, the intelligence, order & benevolence of the Deity. It will not alter our hopes of a future state—it cannot lessen our idea of the dignity of our race to gain such victories over Time. It renders the vastness of the system more apparent, it reconciles us to much that is unintelligible & mysterious.⁵⁸

Such an approach is necessary, otherwise either religious sentiment is void of meaning, as Brontë saw it, or truth itself does not exist. Without religious sentiment life itself is void, as is science without truth. It is therefore important to realize that the progress of science inevitably introduces new problems with every step;

it must always be so, because as the history of the world is one of progress intellectually, it is always emerging from a state of comparative darkness & superstition in which some errors are intermingled with the highest truths of religion—when any of them are modified we cannot but feel alarm & fear.⁵⁹

Progress in the search of truth is part of the advance of the human intellect. This might increase difficulties and doubts, but with this increasing psychological development there will also be more revelation of the spiritual.⁶⁰ Such an approach squares remarkably well with the way Unitarians welcomed and accepted the discoveries of science, and, as I will show in my next chapter, Lyell was more than sympathetic to their doctrines.

⁵⁷ *Scientific Journals*, pp.86, 182.

⁵⁸ *Scientific Journals*, p.121.

⁵⁹ *Scientific Journals*, p.331.

⁶⁰ *Scientific Journals*, p.298. Lyell was not unaware, however, that his pleading for the progress of the human intellect also has its emotional drawbacks: man might not be the end of the series. And here Lyell has no adequate solution at all: “What solace can it be to one who is told that the individuals now living are merely a transient phase of the organic world leading on to a future perfection—a link in a progressive scheme, that if our ancestry were without souls we shall at least have a posterity so superior that they may look on our humble & low position, very much as we do on the Fuegian or native Australian, with pity” (*ibid.* p.378).

CHAPTER SIX

PROGRESS, EDUCATION, AND UNITARIANISM

The years 1835-1845 are a period of religious disquietude in England. If Chartism threatened the already delicate political situation, a series of events and ideas unsettled the faith in the traditions of the Anglican Church which the English had inherited from the eighteenth century. The catholicity of the Anglican Church was continually under attack. Questions about the significance of baptism and other prescribed rituals, the justness of obligatory subscription to the thirty-nine articles for the clergy, and Parliament's power to nominate bishops, were only some of the points on which the church was questioned. Tractarianism seemed to lead to schism: it came to a head for the established church with the publication of *Tract XC* in 1841 which led, in 1845, to its writer, England's leading divine John Henry Newman, becoming a Roman Catholic. Schism, however, did take place in Scotland. In 1843 the Scottish church split into a powerful free church and a weak established church which only just remained in the majority. There was trouble too for the dissenters. Presbyterians doubted the right of Unitarians to hold property originally endowed to Trinitarians and in 1844, after long debate, the Dissenters' Chapel Bill was passed. Moreover, Higher Criticism reaching England from Germany and emerging evolutionary theory unsettled many a religious mind. As a result religion was discussed in the drawing-room, in the press and in Parliament. Pamphlet after pamphlet was written, and it gave rise to a new form of literature—the religious novel—where preaching, theological dialectic, party propaganda and low literary quality often went hand in hand. Geology proper played a relatively small part in all this religious commotion—it was soon to be completely overshadowed by evolutionary theory—and had its impact mainly in its own limited professional circles.

Although both Lyell and Darwin were initially seen as the champions of evolution when it started to emerge,¹ Darwin, who retired to Downe in 1842 and started to lead a life of almost total seclusion, slowly working away on his theory, could afford to ignore religious questions, while Lyell, who was a man of the world and often dined out, could not have escaped religious discussion even if he had wanted to. But, what is more important, Lyell did not eschew

¹ Even when, in 1859, Darwin published his views on evolution, the scientific world eagerly looked forward to Lyell's verdict. When he did not speak out in his *Antiquity of Man* or in the tenth edition of *Principles*, he lost his place as a fighter for evolution.

religious debate but actually showed a sincere interest in it. Thus we encounter a growing number of references to theological points in his writings of the late 1840s and early 1850s which go some way to explaining why Lyell showed so much spiritual resistance to the implications of Darwin's book which his own uniformitarian geology had made possible.

In his two published journals of 1845 and 1849, Lyell recounts his experiences, research and impressions of two successive trips of a year to America.² In his first journal—*Travels in North America* (1845)—geology is still first and foremost, although there are occasional remarks on slavery and religion. His *Second Visit to the United States* (1849) is more outspoken as it discusses religion, education and emancipation at length without the long digressions on his geological finds that characterize the first account. His religious views in these works are very much linked to his ideas of educational reform, and thus to the role of natural history in the curricula of schools and universities.

The recent schism of the Church of Scotland into Established Church and Free Church disgusted Lyell: "there is absolutely no difference of doctrine between the new rival churches in Scotland; and [...] the points of dissent have been deemed for a century and a half of such subordinate importance, as not to afford justifiable grounds for an open breach."³ This kind of sectarianism has a stagnating effect on education, he argues, as each new party immediately demands schools and colleges of their own denomination, whereas existing institutions are inadequately supported. The one million or so people who left the old church, for example, were forced to forego the edifices where they and their progenitors had used to worship. The separatists had to build a great number of new churches and schools. Lyell argued that the necessary funds would only be granted by rich members of the congregations if the new Free Church guaranteed that all possessions would remain in the hands of the denomination in the event of further schism arising. This meant that the founders would have infinite power over future congregations, and thus paralyze the incentive for progress, which was so dear to Lyell. This "power of the dead over the living" was, of course, at the centre of the parliamentary debate over the Dissenter's Chapel Bill in 1844. It was in this year that the Eustace Street Chapel in Dublin was about to lose its yearly £2,600 endowment, following the Lady Hewley Case verdict of 1842. Most old Presbyterian congregations had slowly become Unitarian, still using property and receiving endowments granted originally to Trinitarians during the eighteenth century. By 1844 it had become clear that Presbyterians could challenge the right of

² On July 20, 1841 he sailed with his wife from Liverpool to Boston. They toured the United States, Canada and Nova Scotia for more than a year and returned to England on August 27, 1842. Three years later they left again for the United States, from September 4, 1845 to June 13, 1846.

³ *Travels* i.267.

most Unitarian congregations and strip them of their chapels, burial-grounds and endowments.

Lyell saw in this sectarian fanaticism the greatest obstacle to modern education and the root of the suspicion with which enlightened scientists are often greeted by the people. This lack of trust sprang from the misconception that "religion is not, like other branches of knowledge, progressive in its nature."⁴ Lyell believed that spiritual progress lies at the bottom of educational reform, and educational reform at the bottom of material progress. Knowledge can only be instilled once the religious narrowness has been removed.

What Lyell particularly resented in England was the paralysing influence of the church on education. In a letter to George Ticknor he sharply condemns the stagnating doctrines of the Wesleyans in England "in setting themselves against progress" as well as the "power of the English Church to substitute a sham national education for a real one."⁵ He lamented the fanaticism and narrow-mindedness of many believers. Education is a matter of cultivating one's reasoning powers, but very few people have been trained to judge and think for themselves. The highest merit of a Christian is not "a child-like deference to the authority of churchmen" but a careful investigation of historical evidence.⁶

Lyell, therefore, often feels surprised about the complete emancipation of religion he witnessed in America. He openly admits that at first he was "greatly at a loss to comprehend by what means so large a population had been brought to unite great earnestness of religious feeling with so much real tolerance."⁷ This feeling of surprise steadily grows into admiration. He reports Pastor Robinson's words to the Pilgrim Fathers: "I cannot sufficiently bewail the condition of the reformed churches, who are come to a period in religion, and will go at present no further than the instruments of their first reformation [...] it is an article of your church covenant, that you will be ready to receive whatever truth shall be made known unto you from the written word of God."⁸ Lyell sympathizes fully with this sentiment, which he saw as essentially Unitarian in tenet and which becomes a starting point for his discussion of the advantages of the congregational churches in America over an established national church. Romanists, Protestant churches, Independents as well as most other sects, he argues, are all but "little disposed to cherish the doctrine of the gradual development of Christianity"⁹ which Lyell read in John Robinson's words. This spirit of progress in religious sentiment and thought, however, characterizes the congregational churches which, according to American

⁴ *Second Visit* i.214.

⁵ Undated, 1850, *LLL* ii.169.

⁶ *Second Visit* i.92.

⁷ *Second Visit* i.49.

⁸ *Second Visit* i.210-11. Strangely enough, Lyell does not give his source here.

⁹ *Second Visit* i.211.

common-law, can change their original interpretation of scripture or standard of faith without losing possessions or endowments. This form of breach apparently found favour with Lyell, as it was in the name of progress and did not materially affect the standard of teaching, as school-houses were for the children of all denominations.

Thus Lyell often dwells on the different denominations in each town he visits in America, and goes to church regularly with his hosts. Although he tries to remain objective in his descriptions and comparisons, avoiding comment at most times, there seems to be a certain predilection for Unitarians. This need not surprise us, as a wing of Unitarianism was the offspring of deism; Chadwick describes it as “preaching rational religion, unpoetic common sense, anti-evangelical, suspicious of fervour and enthusiasm, calm in religious life,”¹⁰ and Carpenter admits that it “was marked by calmness rather than fervour; it preferred tranquillity to raptures; and found its strength in the daily walk of duty and faith,”¹¹ the very qualities that would have attracted the rationalist Lyell, who was “sometimes tempted to ask whether good faith and regard for the sacredness of truth is not a rare exception to the rule in Anglo-Saxondom.”¹²

Unitarianism in the 1840s, however, had become more progressive in outlook. Influenced by religious thinkers, such as James Martineau in England and William Ellery Channing in America, it opened itself to scientific discoveries and the findings of Higher Criticism while it shifted its supreme authority from the Bible to man’s interpretation of religious history through reason and consciousness. The American Unitarians were open to educational reform, and Lyell “was very much struck, not only with their good sense and erudition, but with the fervour of their eloquence [... their] earnestness and zeal, as well as of original views and instruction.”¹³ He approved of the scarcity of allusions to the Old Testament, the avoidance of doctrinal points, and the emphasis on the moral precepts and practical lessons from the Gospels.

But Lyell found more in Unitarianism than practical rationalism. He confesses that he “came away assured that they who imagine this form of Christianity to be essentially cold, lifeless, and incapable of reaching the heart, or of powerfully influencing the conduct of men, can never have enjoyed opportunities of listening to their most gifted preachers, or had a large personal intercourse with members of the sect.”¹⁴ Lyell betrays here a deeper religious sentiment than would be expected from his geological dispute with Moses.

Of all the different Unitarian teachers Lyell met in America,¹⁵ he was

¹⁰ Chadwick, *The Victorian Church*, i.396.

¹¹ Carpenter, *James Martineau, Theologian and Teacher*, p.115.

¹² Letter to George Ticknor, undated 1850, *LLL* ii.168.

¹³ *Second Visit* i.175.

¹⁴ *Second Visit* i.176.

¹⁵ Lyell did not miss any occasion in hearing Unitarians preach; he writes that “in the course of my

particularly impressed with the American Unitarian William Ellery Channing, whose sermons he had read and whom he met in Boston in April 1842. Dr Channing strongly sympathized with reform, social and educational, and preached “a rational and amiable system against which no man’s understanding or conscience, or charity, or piety revolts.” Although Lyell found the sermon he went to hear disappointing, he records afterwards that he was introduced to Channing and that they discussed “the bearing of geological discoveries, respecting the earth’s antiquity and the extinct races of animals, on the Mosaic account of the history of man and the creation.”¹⁶ Unfortunately Lyell does not transcribe the discussion itself, which, however, must have been a rather tame affair as Channing had never been interested in natural history or physical science and had not “the slightest knowledge or feeling for such pursuits.”¹⁷ Although Lyell openly admires Channing’s advocacy of stimulating free critical minds as the essence of his educational reform—which comes out in his comparison of Samuel Johnson’s and Channing’s valuation of Milton—he regrets Channing’s lack of interest in physical science. Johnson treated Milton’s—as well as Cowper’s—knowledge of external nature with contempt. Johnson’s limitation lay in cherishing authority and tradition to the extreme and leaving the student “to tread for ever in beaten paths” without giving scope for free individual inquiry. Lyell had taken a similar stand against Whewell, who, in his *Principles of University Education*, seemed to argue that the greatest moral function of Oxford and Cambridge was to instill obedience and deference to authority in the minds of their students. Thus, Lyell objects, “the students are treated more as boys and children than as men on the very point of entering on their several duties in life, and who ought, without loss of time, to be acquiring habits of thinking and judging for themselves.”¹⁸ Channing, however, was free from Johnson’s fear of inquiry. But he still failed to understand that Milton’s emphasis on the importance of the study of nature was two centuries ahead of his time. Much of Milton’s greatness lay there, Lyell asserted.

Apart from educational points of view, Lyell seemed interested in questions of dogma. No doubt, Unitarianism fascinated him. Thus in his *Second Visit* he digresses on the authenticity of a verse in the First Epistle of John (5:7): “For there are three that bear record in heaven, the Father, the Word, and the Holy Ghost: and these three are one.” The authenticity of this verse would, of course, have been good evidence for the doctrine of the trinity. It is, however, spurious

two visits to the United States, I enjoyed opportunities of hearing sermons preached by many of the most eminent Unitarians, - among them were Channing, Henry Ware, Dewey, Bellows, Putnam, and Gannet,” (*Second Visit* i.174-5).

¹⁶ *Travels* ii.2.

¹⁷ *Second Visit* i.203.

¹⁸ *Travels* i.304

as it was not found in most of the better recensions. Luther, therefore, excluded it from his Bible, Erasmus omitted it in his first edition of the New Testament (but reintroduced it in later editions), and Newton asserted the dubious veracity of the passage. Yet it was retained in the English Prayer-Book, in the liturgy of the American Episcopal Church, and was reprinted without comment in the Bibles of all Protestant denominations.¹⁹

The example allowed Lyell to expose the practice of reading the first chapter of Genesis in church without comment. Thus in a letter to his Boston friend George Ticknor he discusses “the want of good faith on the part of the Protestants” shown by the fact that their bibles do not annotate the passage of the “three heavenly witnesses.”²⁰ This is lamentable practice, Lyell argues, as people likewise hear the first chapter of Genesis read in church without commentary and therefore believe in the modern origin of the earth on which man has lived from the very beginning. Moreover, it causes scientists to be regarded with suspicion.

A month before sailing for America a second time, in July 1845, Lyell tells his father-in-law Leonard Horner that he is reading *The Life of Blanco White*, the autobiography of José María Blanco y Crespo, a Roman Catholic priest and later freethinker, who had fled to England when the French invaded Seville in 1810. He anglicized his name and, four years later, became an Anglican. More important here, in later life he turned to Unitarianism. He died in 1841; his autobiography, edited by the Unitarian teacher John Hamilton Thom, was published in 1845. Lyell writes of it that

it should teach every scientific man to modify his opinions, and never to contend for doctrines, because he may have once favoured them, as soon as new discoveries, facts, and reasonings, require their modification or abandonment. The little suffering or annoyance that he, or his self-love, have to endure, is so insignificant in amount in comparison to the penalty which the theological professor must pay for relinquishing a little of any one of the numerous dogmas or forms of interpreting scripture, which he pledged himself to adopt for life, that he must feel ashamed if he hesitates for a moment to recant, after reading the confessions of Saint Blanco the Martyr. For the sake of this moral, which I hope many a philosopher will draw from it, I am glad that all his sufferings are given in full length.²¹

What undoubtedly fascinated Lyell in White’s *Life* was the Spaniard’s unrelenting quest for truth, which articulated the doubts of many Victorian thinkers. A contemporary critic described it as “the secret history of thousands who have felt the same doubts and been urged towards the same conclusions.”²²

¹⁹ *Second Visit* i.222-224.

²⁰ Undated 1850, *LLL* ii.168.

²¹ Letter to Leonard Horner, July 27, 1845, *LLL* ii, 92.

²² J.J. Taylor, in *The Prospective Review* 1 (1845), pp.465-96 quoted in Murphy, *Blanco White*, p.196.

To what extent Lyell shared these doubts is difficult to ascertain, but his attraction to Unitarianism might be indicative.

Lyell's interest in Unitarianism is further sustained by the teachings of James Martineau, whose "doctrine of development"—that religion unfolds itself through time²³—and conviction of the necessity to "escape from partial views and limited sympathies"²⁴ are similar to Channing's. But, on the whole, Martineau's mind was probably more congenial to Lyell's than Channing's. While sharing Channing's progressive ideas of religion and education, Martineau does not ignore the importance of natural science. From early life he showed a strong interest in botany and geology and spent his summer holidays "hammer in hand and 'Phillips' in his pocket [... to] work out the geology of the district."²⁵ Besides, Martineau shows sincere sympathy with the geological cause:

Through what a host of difficulties, amid what a storm of hostility, had geology to struggle into existence! With what countless absurdities of speculation was it long encumbered, what incredible distortion of facts! And all that the dates of the Old Testament might remain intact!²⁶

Geology is not a threat to Martineau, but part of the historically evolving idea of the deity of Christianity. A good instance of this is a review of Dean Mansel's *Limits of Religious Thought* which Martineau wrote in 1859 for the Unitarian *The National*.²⁷ In it Martineau criticized Henry Longueville Mansel's views of religious criticism. Mansel, Reader in Moral and Metaphysical Philosophy at Magdalen College, had been asked for the Bampton lectures of 1858, which were published in the same year. The review is interesting as in a letter to George Ticknor in March 1859 Lyell comments on the theological implications of Martineau's views here.

Martineau starts his review of Mansel's lectures with his reasons for not supporting Butler's views of theism²⁸ and revelation in the latter's *Analogy of Religion Natural and Revealed to the Constitution and Course of Nature* (1736). Butler's book, he argues, is ecclesiastical Christianity addressing the simple theist. If the sceptic of revelation can accept theism with its perplexing difficulties, why should he not accept revelation as well, as both are by the same author and may be expected to share the same features? The absolute analogy

²³ "To the person of Christ Christendom supplies an indispensable commentary," "New Phases" in *Essays* iii. 61.

²⁴ Carpenter, *James Martineau, Theologian and Teacher*, p. 367.

²⁵ Carpenter, *James Martineau, Theologian and Teacher*, pp. 59, 159, 401.

²⁶ "The Existing State of Theology as an Intellectual Pursuit, and Religion as a Moral Influence" (1834), quoted in Carpenter, *James Martineau, Theologian and Teacher*, p. 150.

²⁷ "Mansel's Limits of Religious Thought," pp. 209-227.

²⁸ Martineau uses *theism* as synonymous with *deism*, ie. "belief in the existence of God, with denial of revelation" (*OED*).

between revealed and natural religion allows for either complete acceptance or complete refutation.

Martineau finds such piety and logic doubtful. It is “oppressive to the religious feeling” as it merely duplicates the difficulties of theism in the sphere of revelation and gives as reason for the acceptance of revelation that scepticism brings with it its own difficulties and contradictions, which are not less distressing. Moreover, its logical grounds are weak: if one can wink at the imperfections in the scheme of nature when set off against its “more exceeding glory,” one cannot ignore the difficulties of revelation as they are at the very heart of Christianity. The analogy is, therefore, inconsistent. Besides, the notion “revealed” implies that it supplements “natural,” that its essence is to dissipate darkness: it should not introduce new perplexities.

Mansel’s book fails on exactly the same grounds for Martineau. The dean demonstrates that in nature there is a necessary contradiction, on logical grounds, between entity and phenomenon. Our mind cannot solve the paradox of Infinite and Finite, Time and Succession, Absolute and Personal. The same state of mind will confuse our ideas when brought to the scheme of redemption. Therefore, to Mansel it is not “that God has set similar puzzles in the world as in the gospel, but that man brings the same logical disqualification to both.”²⁹

The conclusion from the whole is, that, in our natural Theism, we must hold to *both* of the incompatible terms, the existence of the Infinite that can have no predicates, and the truth of the Finite predicates he cannot have; and that, bringing this state of mind to the scheme of Redemption, we are in no condition to cast the first stone at its seeming inconsistencies, but are bound to content ourselves with estimating its evidences, without attempting a critique of its doctrines.³⁰

Martineau again retorts that this only duplicates perplexities, and logically works on the same plane as Butler’s: if there is a legitimate belief in the existence of the Infinite—which is not given—it can only exist if predicates can be affixed to it. But as Mansel denies the possibility of the Infinite having predicates, revelation cannot exist. What has no predicates cannot reveal itself to us.

Martineau denies “the doctrine of the religious incompetency of the human fallacies.” Infinite and Finite do not exclude each other, but are intimately interlinked. “We *believe*, though we cannot *conceive*, the infinitude of space and time: and these beliefs take their place and perform their proper intellectual function in processes of rigorous scientific reasoning [...]. We have entire faith in the veracity, and in the consistency, of the reports given in by our highest faculties; and think it possible, even within our segment of a life, to trace their

²⁹ “Mansel’s Limits of Religious Thought,” p.215.

³⁰ “Mansel’s Limits of Religious Thought,” p.219.

convergence towards one Divine and Holy Reality.”³¹ The conclusions of the investigating mind cannot be dismissed by a plea for subjective incompetence. On the contrary, the findings of Strauss on the historicalness of Christ, for example, “have produced an ineffaceable impression on Christian theology [...] No orthodoxy can excuse a scholar from recognising scholarship.”³²

At the very beginning of his career as a geologist and writer, Lyell had been much influenced by Bishop Butler’s classic work on analogy. Butler’s system lent itself well to Lyell’s geological theory. Analogy, in Butler’s sense, would cancel out imperfections as they are merely manifestations of general laws we have not yet discovered. Perplexing past phenomena could thus be explained through analogy with geological processes in the present. Lyell realized the power of Butler’s reasoning and in his first published paper of 1828 he quotes Butler. Much of the power of *Principles* comes from Lyell’s analogical reasoning: “The mind is prepared by the contemplation of such future revolutions to look for the signs of others, of an analogous nature, in the monuments of the past.”³³ The present as a key to the past, the past to the present.

This would have made Lyell interested in Martineau’s article. It is questionable if analogy was still the valid instrument to Lyell which helped to explain the relation between nature and revelation as well. If natural selection ruled, redemption was difficult to sustain. Though Lyell is firmly anti-Mosaic, it is important to keep in mind that he is not antagonistic to Christianity in general. In a sense he still belonged to a school of scientists who thought that science and religion, scientific fact and divine ideal, could ultimately be harmoniously united. A few years after the publication of *The Origin of Species* he remarks with telling sadness that the implied descent of man from brutes “takes away much of the charm from my speculations on the past relating to such matters.”³⁴ Thus he is tempted to go along with Martineau, who restores with serenity the relationship in which science stands to religion without damaging the one or the other. He admits after reading the latter’s review on Mansel’s *Limits*: “how much more comfortable and consolatory is the system of creation, or the divine dispensation, when viewed from a Unitarian than from an orthodox point of view.”³⁵ Although nominally an Anglican, he here contrasts Anglicanism, which was so much characterized by the natural theology school of Butler and Paley, against Unitarianism.³⁶

³¹ “Mansel’s Limits of Religious Thought,” pp.224,226.

³² “Mansel’s Limits of Religious Thought,” p.227.

³³ *Principles* ii.157. This volume of the *Principles* abounds with marked analogies, for example, on pages 51, 61, 62, 73, 75, 84, 85, 103, 105, 122, 126, 129, 166, 169, 178, 206, 216, 226, 227, 229, 264, 275, 277, 286, 288, 292, 294, 296.

³⁴ Letter to Charles Darwin, March 11, 1863, *LLL* ii.363.

³⁵ To George Ticknor, March 11, 1859, *LLL* ii.322.

³⁶ The fact that Lyell remained nominally an Anglican throughout his life has, no doubt, a practical aspect. For example, he married Mary Horner in Bonn (July 12, 1832) because the Horners happened

When he wrote his comment on Martineau's article, Lyell had probably already met this leading English Unitarian. Martineau had earned national fame as a divine when, in 1857, he left his Liverpool congregation for the London congregation of Little Portland Street Chapel. At what exact point Lyell became a habitual worshipper with Martineau's congregation is difficult to establish, but it is clear that the ties between the Lyells and Martineau strengthened in later years. Frances Power Cobbe writes in 1900 that the Lyells "had been for many years devoted members of the Portland Street congregation; and when Miss Loyd and I repaired (as was our wont) to their house in Harley Street after the morning service every Sunday, Sir Charles' admiration for the sermon was often expressed with enthusiasm."³⁷ A letter of consolation years later from Martineau on the death of Lady Lyell testifies to a relationship which, although not of intimate friendship, is still more than mere respect and casual acquaintance: "Without encroaching on the privilege of nearer friends to speak intimately of all the graces and wealth of character whose support has been taken from your side, I may perhaps confess the almost unique impression which Lady Lyell always left upon me."³⁸ Considering the evidence of Lyell's interest in Unitarianism, the widely held idea that "Sir Charles Lyell remained a practising Anglican" is questionable.³⁹ His increasing interest in Unitarian questions is without doubt. Miss Cobbe adds that "after his wife died, his interest in all religious questions, and especially in that of a Future Life, became very prominent in all his conversation."⁴⁰

to live abroad temporally and Leonard Horner was not willing to return to Scotland for his daughter's wedding. Although lawfully wedded, Lyell insisted on a second ceremony in England, which took place in September, to assure the legal validity of the marriage.

³⁷ "Recollections of James Martineau," pp.183-4.

³⁸ May 1, 1873, in "Recollections of James Martineau," p.184.

³⁹ Chadwick, *The Victorian Church* ii.6.

⁴⁰ "Recollections of James Martineau," p.184.

PART TWO
THE CLERGY

CHAPTER SEVEN

WILLIAM BUCKLAND: BRIDGE-OVER-THE-WATER

William Buckland is perhaps the most representative early nineteenth-century church dignitary who was at the same time a professional geologist. This double function led to much controversy, both in religious and in scientific circles.

When, in 1819, Buckland obtained the first chair of geology at the University of Oxford, he stressed in his inaugural lecture that the facts of geology were not only consistent with the accounts of the creation and the deluge as recorded by Moses but that they were also proof of the continued superintendence of the intelligence of the Creator. Not surprisingly, in the eyes of many scientists and clergymen Buckland became the English champion of the veracity of Genesis and one of the major advocates of diluvialism.¹ He was a close friend of Baron Cuvier, whose conclusions he espoused, and who in turn admitted his esteem for Buckland.² Such a Mosaic stand, however, could not last as geologists vastly increased the quantity of geological facts. If in his early career Buckland could confidently expound on the veracity of the Mosaic flood, the continued absence of human remains in diluvial deposits, John Fleming's criticism, and Lyell's conclusions, at first presented to the Geological Society and later published in *Principles of Geology*, made it necessary for Buckland to reduce those points in his theory that supported the deluge. By so doing, without giving up his natural theology, Buckland found himself belonging to two different factions. His renunciation of the universality of the flood, in fact, did not pass without hostile comment from other clergymen, nor were the professional scientists willing to embrace the implications of his natural theology. Witness, for example, a clergyman's comment on Buckland's position:

By the scientific world, Dr. Buckland is found fault with for mixing up theology

¹ Rupke has argued for Buckland's Mosaic stand as a "mise-en-scène" to get geology accepted as an autonomous discipline in the curriculum of Oxford University, which was still predominantly based on classical learning (*The Great Chain of History*, pp.58-9). Much of Buckland's writing, however, reflects a genuine belief in the principle of natural theology, which culminated in his *Bridgewater Treatise* of 1836. Not all the links he saw between geology and religion can therefore be ascribed to a strategy to convince the university authorities of the edifying qualities of the new science in terms of religion.

² Cuvier wrote in 1825 of Buckland as "un des hommes qui honorent la géologie par les observations précises et suivies," (*Ossements Fossiles* v.2), and again on Buckland's description of the Kirkdale cave: "le savant et ingénieux géologue," (quoted in *Reliquiae Diluvianiae*, p.231).

with science, and for not treating the subject as an abstract question; by a large part of the religious world he is condemned as introducing dangerous innovations, and shaking our faith without satisfying the doubts his investigations have suggested.³

Born in 1784, Buckland was Lyell's senior by thirteen years. Like Lyell, he showed an early interest in nature, and, as a boy he explored the surroundings of his native town Axminster for fossils and other objects of natural interest, often extending his walks to Charmouth and Lyme Regis, probably the most instructive sites for collecting fossils in the British Isles. After his schooldays at Winchester he won a scholarship to Corpus Christi College, Oxford, where he graduated in 1804. His knowledge of geology, in the meantime, was steadily growing during his country-walks with Joseph Townsend and William Broderip. In 1809 he took orders and was elected Fellow of Corpus Christi. His growing collection of rocks and fossils brought him fame and this led to his nomination as Reader in Mineralogy in 1813 and in 1819 to his professorial title in geology. As a lecturer, Buckland had an electrifying influence on his audience, as a poem by Richard Whately, later Archbishop of Dublin, records:

His eloquence rolled like the deluge retiring,
Where mastodon carcasses floated;
To a subject obscure he gave charms so inspiring,
Young and old on geology doated.
He stood out like an Outlier; his hearers, admiring,
In pencil each anecdote noted.⁴

Lyell's fascination with geology must in part be attributed to Buckland's inspiring lectures as Reader in Mineralogy, which Lyell started attending in 1817. Other eminent Victorians who fell under the professor's spell were John Henry Newman, John Ruskin, Thomas Arnold, Samuel Wilberforce and William Howley, later Archbishop of Canterbury.

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Buckland's position as a clergyman and geologist is summed up in his inaugural lecture of 1819, later published as *Vindiciae Geologicae; or, the Connexion of Geology with Religion Explained*. Geology, he announces in the dedication to William Wyndham, Chancellor of the University of Oxford, "has a tendency to confirm the evidences of natural religion; and [...] the facts developed by it are consistent with the accounts of the creation and deluge recorded in the mosaic writings." This he set out to prove both in the lecture and in *Reliquiae Diluvianae*, published 4 years later in 1823. Although his

³ Best, *After Thoughts on Reading Dr. Buckland's Bridgewater Treatise*, p.2.

⁴ "Elegy Intended for Professor Buckland" (1820) in Daubeny, *Fugitive Poems Connected with Natural History and Physical Science*, p.88.

scientific views changed when the improbability of a universal Mosaic deluge grew, his theological presuppositions remained unaltered. In 1819, for example, he announced that “the evidences afforded by Geological phenomena may enable us to lay more securely the very foundations of Natural Theology.” The very affirmation is reported in his famous Bridgewater Treatise of 1836: *Geology and Mineralogy*.⁵ Although Buckland does not deny the direct pecuniary importance of geology and its reciprocal importance for a wide range of other sciences, such as comparative anatomy, chemistry, pure mathematics, hydrostatics, physical geography, and astronomy, its real importance rests on its capacity to “call into action the higher powers of the mind.”⁶ To find order and origin in the seemingly chaotic state of nature and amid the evidence of “convulsions of which the most terrible catastrophes presented by the actual state of things [...] afford only a faint image” is no mean feat, but such an application of the science will remain sterile if it “shall not terminate in the Great First Cause.”⁷

Buckland’s natural theology in geology goes much further and is more practical (utilitarian) than that of the professional geologists a generation later. In 1819 he makes a great case out of the providential nature of strata, which from their original horizontal position had been inclined in such a way that minerals which otherwise would have remained hidden become available to man. Faults—breaks in the continuity of strata—are thus seen as divine contrivances to make minerals accessible to man. It is a sentiment which in geology belongs to the generation of Deluc rather than to the generation of Lyell and Sedgwick—Deluc could write with all confidence: “Qui ne voit ici la main de Dieu, préparant d’avance [...] les nouvelles habitations des hommes?”⁸—and is part of a more general sentiment in society which resulted in the later Victorian self-complacent feeling that England was the elect country, proved by its industrial superiority. Even in *Geology and Mineralogy*, Buckland’s typical procedure in each chapter is of description of how the system of nature works. Because it works it is seen as proof of the existence of providence. Such is the conclusion of many a chapter. There is no ulterior investigation into the nature of the argument and often cause and effect are not distinguished. How far Buckland was steeped in this kind of aprioristic natural theology and anthropocentric utilitarianism becomes clear in the following example of 1819:

It is no small proof of design in the arrangement of the materials that compose the surface of our earth, that whereas the primitive and granitic rocks are least calculated to afford a fertile soil, they are for the most part made to constitute the

⁵ *Vindiciae Geologicae*, p.20; *Geology and Mineralogy* i.56.

⁶ *Vindiciae*, p.5.

⁷ *Vindiciae*, p.5,11.

⁸ Quoted in *Vindiciae*, p.17.

mountain districts of the world, which, from their elevation and irregularities, would otherwise be but ill adapted for human habitation; whilst the lower and more temperate regions are usually composed of derivative or secondary strata, in which the compound nature of their ingredients qualifies them to be of the greatest utility to mankind.⁹

Not even Paley went so far. Buckland soon realized that he had to moderate such a view, but when he did so in 1836, it resulted in the following ambiguous statements, from which it is clear that his teleological outlook had not changed much:

I would in this, as in all other cases, be unwilling to press the theory of relation to the human, so far as to contend that all the great geological phenomena we have been considering were conducted *solely* and *exclusively* with a view to the benefit of man. We may rather count the advantages he derives from them as incidental and residuary consequences; which, although they may not have formed the exclusive object of the creation, were all foreseen and comprehended in the plans of the Great Architect of that Globe, which, in his appointed time, was destined to become the scene of human habitation.¹⁰

and again,

however remote may have been the periods at which these materials of future beneficial dispensations were laid up in store, we may fairly assume, that, besides the immediate purposes effected at or before the time of their deposition in the strata of the Earth, an ulterior prospective view to the future uses of Man formed part of the design, with which they were, ages ago, disposed in a manner so admirably adapted to the benefit of the Human Race.¹¹

The difficulties of the first chapter of Genesis are much diminished if we acknowledge the support geology gives to our notions of providence. But all the same, Buckland could not pass over the more conspicuous discrepancies between the Mosaic account of the creation and the geological evidence without an attempt at reconciliation.

In 1819 a few words sufficed to show that there was no real contradiction: geology confirmed all that revelation disclosed. Geology had found a period void of organic beings, which implied the introduction of the vegetable and animal world in a second moment. Such a beginning could only be found in the fiat of the “all-wise Creator” and invalidates any Huttonian speculation on “an infinite series of revolutions without the traces of a beginning.”¹² And answering Thomas Chalmers’ attack on the infidelity of the geologists, Buckland retorts that the “yet imperfect science of Geology” cannot imperil the truth of scripture. Geology shows that man cannot have existed before the time assigned by Moses. The deluge itself is so well-documented by the facts

⁹ *Vindiciae*, pp.17-18.

¹⁰ *Geology and Mineralogy* i.97-8.

¹¹ *Geology and Mineralogy* i.497-8.

¹² *Vindiciae*, p.21.

of geology “that, had we never heard of such an event from Scripture, or any other authority, Geology of itself must have called in the assistance of some such catastrophe.”¹³ That the present state of nature might have been built upon the ruin and wreck of a former state is nowhere contradicted in Genesis. The ‘beginning’ mentioned in the Mosaic account depends very much on the interpretation of ‘the Word’, which might mean “an indefinite period of time,” while the days might not refer to what is now a single revolution of the earth.

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Reliquiae Diluvianae is Buckland’s first scientific contribution to the theological significance which he had claimed for geology in his inaugural lecture of 1819. Although the book is sound scientific description and is devoid of religious intrusions, the subtitle clearly indicates that the reader should not lose sight of the proof it afforded for biblical veracity: *Observations on the Organic Remains Contained in Caves, Fissures, and Diluvial Gravel, and on Other Geological Phenomena, Attesting the Action of an Universal Deluge*. It was meant as a cumulative account of the geological facts which proved the reality of a universal deluge. The dedication makes this clear:

[my inquiry] has, already, produced conclusions, which throw new light on a period of much obscurity in the physical history of our globe; and, by affording the strongest evidence of an universal deluge, leads us to hope, that it will no longer be asserted, as it has been by high authorities, that geology supplies no proofs of an event in the reality of which the truth of the Mosaic records is so materially involved.¹⁴

In *Reliquiae Diluvianae* Buckland describes a great number of caves in England and on the continent and from the bones found in them draws his conclusion that these discoveries accord with the Mosaic account of the flood. Buckland is positive that the caves “have been once and once only submitted to the action of a deluge”¹⁵ and that “the period at which the earth was inhabited by all the animals in question was that immediately antecedent to the formation of those superficial and almost universal deposits of loam and gravel, which are impossible to account for unless they are ascribed to a transient deluge, affecting universally, simultaneously, and at no very distant period, the entire surface of our planet.”¹⁶

Thus the book is positive about the historical reality of the Mosaic flood, but does not attempt to account for the creation itself. It is curiously silent

¹³ *Vindiciae*, p.23.

¹⁴ From the dedicatory letter to Shute Barrington, Bishop of Durham; *Reliquiae Diluvianae*, p.iii.

¹⁵ *Reliquiae*, p.108.

¹⁶ *Reliquiae*, p.146.

about that. Buckland distinguished himself from eighteenth-century geologists by resisting the urge to build systems of cosmogony. His book contains sound scientific argument and his conclusions are never forced to comply with scripture. His reasoning admits of “former worlds,” to whose necessary existence Buckland was not blind, but he does not go into detail or affirmation. It is true that he deducted from the limited quantity of postdiluvian stalactite covering the bones in caves “that the time elapsed since the introduction of the diluvian mud has not been one of excessive length”—his estimate is five or six thousand years at the most¹⁷—but this merely confirmed the geological conclusions of the main catastrophists Cuvier and Deluc. Buckland reaches such conclusions through inductive reasoning, not through a desire to make them conform to Genesis. The theologian of the dedication had changed places with the geologist in the countless examples which exclusively serve to prove the existence of a universal transient deluge. No reference is made to Scripture, nor to the Divine Author of the flood.

Buckland saw his universal transient deluge, rather than postdiluvian agents, as the force that had excavated the now existing valleys. Not all geologists, however, were willing to subscribe to such conclusions about the flood. John Fleming, a Scottish Presbyterian minister and naturalist, started the debate about valleys and the flood which contributed to the final refutation of the biblical deluge within a few years. Although Fleming was a conscientious clergyman who enjoyed great popularity in his parish, his early interest in natural history had turned him into an able scientist. Lyell, who disagreed with most geologists in the late 1820s, found in Fleming one of the few scientists who held uniformitarian ideas. Fleming’s qualities were recognized by the scientific world as well: in 1834 he was offered the chair of Natural Philosophy at King’s College, Aberdeen and after the schism in the Scottish Church in 1843 he followed Chalmers into the Free Church and was offered the chair of Natural Science at Free Church College, Edinburgh, in 1845.

In an article published in 1826 Fleming contested *Reliquiae Diluvianae* both because of its theological and geological suppositions.¹⁸ Although he did believe in the authority of revelation, he argues that various geological facts do not square with what we read in Genesis. If the Bible says that of *all* animals a pair survived in the ark, then the geologist cannot ascribe the extinction of many “antediluvian” species to the deluge. If Moses’s account is based on forty days of rain and a gradual subsiding of the waters afterwards, the geologist may not add to this “furious movements of the waters” to account for the excavation of valleys: in that case the ark would have been “driven violently to and fro [while] on the contrary, there is reason to believe, from the

¹⁷ *Reliquiae*, p. 51.

¹⁸ “The Geological Deluge, as interpreted by Baron Cuvier and Professor Buckland, inconsistent with the testimony of Moses and the Phenomena Nature,” pp. 203–239.

writings of Moses, that the ark had not drifted far from the spot where it was first lifted up, and that it grounded at no great distance from the same spot.”¹⁹ Moreover, Moses does not mention the radical change of the surface of the earth after a cataclysmic deluge, which could not have been excluded from the narrative without being

induced to question the accuracy of Moses as an historian, or the claims of the Book of Genesis to occupy its present place in the sacred record. Instead of finding the Deity setting his bow in the cloud, as a pledge that he would not again visit the earth with a flood, and as the *only natural token* of what had happened; [...] I had expected to find a reference made to every diluvian heap of gravel, and every valley of denudation, as memorial of that wrath which was displayed, while visiting rebellion with death.²⁰

Therefore Buckland’s proof of the Mosaic flood cannot be brought into accordance with the Biblical story itself. Such a conclusion should not be seen as a conclusive blow against the historicalness of the deluge, but as refuting the presupposed harmony between geological discovery and Mosaic history. Fleming concludes that, because he believes in the Mosaic account, “I am not prepared to witness *in nature* any remaining *marks* of the catastrophe, and I feel my respect for the authority of revealed revelation heightened, when I see on the present surface no memorial of the event.”²¹

This part of the article was least influential in the debate but in retrospect it is most refreshing as a theological interpretation of the problem. It was Fleming’s geological objections, however, which carried most weight and led to correspondence on the subject with Lyell. Most geological evidence for the deluge was entirely inconclusive to Fleming. He expected a universal flood, for example, to leave similar loam in all gravelbeds or similar mud in caves all over England, while the loam and mud actually varied according to the nature of neighbouring hills. This argued for a local rather than a universal character of flooding. The imbedded remains of extinct animals also argued against a violent and universal deluge. Carcases would have floated on the mighty currents of such an event far from the place where they had lived, and tropical species would have mixed with native ones. “Yet there is no such confusion; consequently there have been no such mighty currents.”²² Most influential, however, was Fleming’s criticism of Buckland’s diluvian valleys. After describing the shape of these so-called “valleys of denudation,” he objects that he cannot conceive a way of how a deluge could have made them as they are. These valleys are never straight and always widen as they descend. As rivers have the tendency to produce oscillations at their bottom and widen

¹⁹ “Geological Deluge,” p.213.

²⁰ “Geological Deluge,” pp.214-215.

²¹ “Geological Deluge,” p.214.

²² “Geological Deluge,” p.233.

as their water increases when lateral streams join them, “I feel myself compelled to conclude, that the old valleys, with the characters described, have been produced, like those forming under my eye, *by the long-continued action of running water at the bottom*.”²³ Fleming made Buckland’s diluvian theory rather shaky and probably prevented him from publishing a second edition of *Reliquiae Diluvianae*.

The climax in the diluvian debate, however, came in June 1829 when, as a reaction to a joint paper by Lyell and Murchison in which they had shown the enormous excavating power of rivers, Conybeare read to the Geological Society a paper on the Thames, of which Buckland had allegedly written half.²⁴ Conybeare’s conclusions could not hold and helped the fluvialist cause. Lyell records it in a letter to Mantell:

The last discharge of Conybeare’s artillery, served by the great Oxford engineer against the Fluvialists, as they are pleased to term us, drew upon them on Friday a sharp volley of musketry from all sides, and such a broadside at the finale from Sedgwick, as was enough to sink the “*Reliquiae Diluvianae*” for ever.²⁵

The battle was, however, mainly fought during the meetings of the Geological Society. Lyell’s published reaction to Buckland’s diluvialism, for example, is more temperate. In the second volume of *Principles*, Lyell praises Buckland’s “indefatigable researches” without openly controverting the latter’s conclusions. He brings forward some contrary evidence of different strata in caverns—Buckland had found evidence of one deluge only—but assures the reader that “this exception does not invalidate the generality of the phenomenon observed by the Professor.”²⁶ Evidence of one sediment could easily be explained either by the sheer force of the latest flood in eliminating earlier sediments, or, in case of torrents cutting their channels through cavernous masses, by the lowering of the drainage level so that no other transported matter could be added to the original sediment. This conclusion, of course, is as far from Buckland’s conclusion as can be: it clearly denies the agency of one universal flood.

Lyell’s dismissal of Buckland’s valley-theory in support of the Mosaic flood goes almost unnoticed in *Principles*; Lyell does not want to join the controversy about the formation of valleys, but nevertheless adds that the formation of valleys is a complex process of mechanical and chemical agents during different geological epochs, depending on subterranean movements and change of climate. The clamour of the discussions at the Geological Society have become an inoffensive statement that “some writers of distinguished talent have gone so far as to contend, that the origin of the greater number of existing valleys was simply due to the agency of one cause,

²³ “Geological Deluge,” p.217.

²⁴ See Lyell to Fleming, June 10, 1829, *LLL* i.254.

²⁵ June 7, 1829, *LLL* i.253.

²⁶ *Principles* ii.219-227.

and that it was consummated in a brief period of time.”²⁷ This is another example of how Lyell tried to limit his discussion to the bare facts in order to avoid the accusation of openly controverting Buckland and with him Moses. But the accusations came all the same. In 1833 Lyell feels obliged to be more outspoken about the Mosaic flood, to prove both the inadequacy of its evidence and to deny any irreligious motives on the writer’s part.²⁸ On the whole, Lyell discovered that Buckland’s Mosaic influence in geology was still clearly felt in the 1830s, and that it was reassuring to the clergy.

Nicholas Wiseman, for example, the future Roman Catholic Archbishop of Westminster, gave two lectures on geology before the University of Rome which he included in *Connexion Between Science and Revealed Religion* in 1836. It is remarkable how he ignores Lyell’s contributions to the science while he unconditionally espouses Buckland’s conclusions. Wiseman argues from a purely theological point of view. His is a belief in progress which does not despair of a future reconciliation of science with revealed religion, because if the representation geologists “have given of nature are the fictions of men, they cannot stand against the progress of science; if they truly picture the work of God, they must be easily reconcilable with his revealed manifestations.”²⁹ Buckland’s conclusions, he writes, confirm that geological facts disprove neither the Mosaic account of the creation nor the deluge. Notwithstanding Fleming’s article, Lyell’s *Principles*, or Sedgwick’s public recantation of the flood, *Reliquiae Diluvianae* gave Wiseman sufficient proof for the reality of the deluge.

Wiseman was not a geologist and reduced geology very much to the handmaid of faith. Although he wanted to avoid judging geology from the point of view of natural theology, he concluded that the progress of modern science impresses upon the mind

the great seal of creation, whereon have been engraven, by an Almighty hand, mystical characters of the deepest wisdom, omnipotent spells of productive power, and emblems most expressive of an all-embracing, all-preserving love.³⁰

Wiseman’s lectures were not, of course, influential on the progress of geological thinking, but they are a telling example of the attraction of Buckland’s conclusions to the religious mind and of the popular prejudice against the anti-mosaicists. The *Reliquiae Diluvianae* had not yet been sunk altogether.

Buckland himself, however, could no longer maintain such notions about the deluge in 1836. Thus in *Geology and Mineralogy*, published in the very same year as Wiseman’s lectures, he modified his belief in the flood as follows:

²⁷ *Principles* i.172.

²⁸ *Principles* iii.270-4. Lyell here admits he has been led into the discussion with “great reluctance.”

²⁹ *Twelve Lectures on the Connexion between Science and Revealed Religion* i.289.

³⁰ *Twelve Lectures* i.370.

one of the last great physical events that have affected the surface of our globe, was a violent inundation, which overwhelmed great part of the northern hemisphere [...] The description of the facts that form the evidence presented in this volume, is kept distinct from the question of the identity of the event attested by them, with any deluge recorded in history [...] it seems more probable, that the event in question was the last of the many geological revolutions that have been produced by violent irruptions of water, rather than the comparatively tranquil inundation described in the Inspired Narrative.³¹

Fossils could not be attributed to the Mosaic deluge, because the strata in which they were imbedded “were deposited slowly and gradually, during long periods of time, and at widely distant intervals. These extinct animals and vegetables could therefore have formed no part of the creation with which we are immediately connected.” Although the figurative sense of the six days of the creation was in itself acceptable to Buckland, it might not be necessary to resort to such an interpretation if geological time could be fitted in the “undefined interval, following the announcement of the first verse.” The beginning recounted in the first verse of Genesis might have been followed by the physical events of which geology bears witness during millions of millions of years before the commencement of the first day. The second verse, then, described the state of the earth at the beginning of the first day (evening), which is *tohu bohu*, without form and void, chaos, the geological “wreck and ruins of a former world.”³²

His new conclusions, therefore, did not invalidate the Mosaic account for Buckland. In the chapter entitled “Consistency of Geological Discoveries with Sacred History” he admits that many learned and religious men regard the discoveries of geology with distrust and total incredulity because of the supposed disruptive nature of geology on “minds which have been long accustomed to date the origin of the universe, as well as that of the human race, from an era of about six thousand years ago.” But, Buckland emphasizes, “geology has shared the fate of other infant sciences in being for a while considered hostile to revealed religion; but, when fully understood, it will be found a potent and consistent auxiliary to it, exalting our conviction of the Power, and Wisdom, and Goodness of the Creator,” notwithstanding the fact that “the early and deliberative stages of scientific discovery are always those of perplexity and alarm.”³³

Modification of the popular interpretation of the Mosaic narrative, moreover, did not involve impeachment of its authenticity at all. “The disappointment of those who look for a detailed account of geological phenomena in the Bible, rests on a gratuitous expectation of finding therein historical information, respecting all the operations of the Creator in times

³¹ *Geology and Mineralogy* i.93-4.

³² *Geology and Mineralogy* i.15,17.

³³ *Geology and Mineralogy* i.8-9.

and places with which the human race has no concern." The Bible is intended only as "a guide of religious belief and moral conduct." It would be impossible for revelation to contain without imperfections and omissions a complete account of God's omniscience. Such a revelation would have been too exalted for the creatures to whom it was addressed. The design of revelation is not to impart intellectual knowledge, but moral knowledge.³⁴ Buckland reminds the reader that "the question is not respecting the correctness of the Mosaic narrative, but of our interpretation of it; and still further, it should be borne in mind that the object of this account was, not to state *in what manner*, but *by whom*, the world was made." In the end, he has no doubt that his explanation as given above is in harmony with revelation and he reassures the reader that the question considered in this light "will reconcile even the letter of the text of Genesis with the phenomena of Geology."³⁵

Buckland's Bridgewater Treatise raised a storm of clerical protest all the same. Baron Bunsen wrote to his wife in 1839 that Buckland was persecuted by bigots and charged with open infidelity because he asserted that the fossils proved that death existed before Adam's fall.³⁶ Numerous pamphlets were addressed to Buckland by members of the cloth, and his controversial position as a geologist in the church clung to him for the rest of his life. We often get impressions in Lyell's correspondence of the asperity with which scripturalists treated honest scientists, but taken on the whole his comments are humorous or at the worst expressions of annoyance. Because of his position in the church, the attack against Buckland, on the other hand, must have been hard to bear for a man who had proposed his science as the very foundation of natural theology. It was surely an ordeal for Mrs Buckland who felt she had to defend her husband's reputation upon his nomination as Dean of Westminster:

I think Sir R. Peel has shown much moral courage in making choice of a person of science, for it was sure to raise a clamour, and among good people too. It has always been quite unintelligible to me how it happens that on the Continent, where there is far less religion than in England, a man who cultivates Natural History, who studies only the works of his Maker, is highly considered and raised by common consent to posts of honour, as were Cuvier, Humboldt, etc.,—while, on the contrary, in England, a man who pursues science to a religious end (even who writes a Bridgewater Treatise) is looked upon with suspicion, and, by the greatest number of those who study only the works of man, with contempt.³⁷

Typical of the attitude of "suspicion" and "contempt" is William Cockburn, Dean of York, who with a pamphlet entitled *A Letter to Professor Buckland*

³⁴ *Geology and Mineralogy* i.13.

³⁵ *Geology and Mineralogy* note i.29.

³⁶ April 1839, in Gordon, *The Life and Correspondence of William Buckland*, p.136.

³⁷ Letter to Sir Philip Egerton, November 1845, in Gordon, *The Life and Correspondence of William Buckland*, p.220.

Concerning the Origin of the World in which he challenged Buckland's "former worlds" started his life-long crusade against geology. In the pamphlet, which went through numerous editions, he finds Buckland's geological facts altogether inconclusive, particularly since the historical account given by Moses was more than adequate in itself. Cockburn, like many other mosaicists was not willing to concede a longer time-span for the history of the earth, or to give up the Noachian deluge. Following the text of Genesis step by step, he attributes the primitive rocks to the creation in the "beginning." Subsequently these rocks were covered by the waters which were finally gathered in one place. Life was created on the dry land then appearing till finally man was formed and became a living soul. This initial state lasted until the flood, as "we read of no convulsions, no storms, no variations."³⁸ The flood alone, then, could have caused the strata with their imbedded fossils as we find them now. When Moses writes that "all the fountains of the great deep [were] broken up," Cockburn reads in this—because it says "break up" not "break in"³⁹—the action of marine volcanoes, which would have disintegrated the primitive rock and formed new combinations, embedding organic remains. Dinosaurs, ichthyosaurs and the like would have been too heavy for the ark, and were left to be drowned. Man, conceiving the danger of the rising waters, would have fled towards the highest peaks where, however, he too would finally be annihilated. His lifeless body would float off and gradually subside and decompose at the bottom of the universal ocean, thus occupying the last position in the geological series.

Cockburn's is a good example of how the Mosaic history was sufficient to explain the past of the earth for many a believer, reducing all geological phenomena to one great convulsion, the flood. Another is S. Best's pamphlet on Buckland's *Bridgewater Treatise* in which the author, also a clergyman, wants to "humble the lofty front of science": the discoveries of man are to him "the bubbles of a day" which "will fall [...] before the steady light of revelation."⁴⁰ What Best objects to in Buckland's theory is the way man is made to seem insignificant against the vast background of geological time: although Best "would not unduly exalt the nature of man, [it ...] lower[s] the value of intelligence, if we suppose worlds thus to be created for the sole occupancy of brutes without reason."⁴¹ He sees moreover no logical necessity for successive creations and former worlds as a former existence of saurians can be accounted for as follows:

What are all the monsters of antiquity which have been hitherto looked upon as fabulous, and which men were deified for destroying? what were all the wonders

³⁸ *Letter to Professor Buckland*, p.13.

³⁹ Cockburn does not examine the Hebrew text here, but simply quotes from the Authorized Version.

⁴⁰ *After Thoughts*, p.3.

⁴¹ *After Thoughts*, p.18.

of Hercules and his contemporaries? [...] tradition is in favour of such monsters having once existed with man.⁴²

Well-argued criticism in the overconfident style reminiscent of the *Quarterly Review* came more than two decades later in 1860, four years after Buckland's death. In the late 1850s Benjamin Jowett and Frederick Temple, both Anglican clergymen, decided to ask various authors freely to discuss a number of Biblical questions. These were collected and edited by H.B. Wilson and published as *Essays and Reviews*, a volume which created a furore on account of its liberal tenet in theological questions. One of the essays was written by the Cambridge Egyptologist Charles Wycliffe Goodwin, who contributed with a discussion of the Mosaic cosmogony.

Goodwin attacked, amongst others, Buckland's interpretation of the Pentateuchal account. If days should be read as periods what, then, is one to do with "God blessed the seventh day, and sanctified it"? And when Buckland supposes Genesis 1:2-3 to refer to the clearing of a temporary vapour, he asks: "Can any one sensible of the value of words suppose, that nothing more here is described, or intended to be described, than the partial clearing away of a fog?"⁴³ Apart from differing with Buckland in the interpretation of the wording of Genesis, Goodwin's main point is the lack of humbleness in those clergymen who "insist upon bending facts to [their] unyielding standard":

If, then, it is plain that He has not thought it needful to communicate to the writer of the Cosmogony that knowledge which modern researches have revealed, why do we not acknowledge this, except that it conflicts with a human theory which presumes to point out how God ought to have instructed man?⁴⁴

Goodwin concurs with Buckland that the Mosaic cosmogony was a simplistic view of the creation which was held in an earlier age, but goes beyond him, stripping the account of any mystical, symbolical or inspirational meaning, when he asserts that it was only "the speculation of some Hebrew Descartes or Newton, promulgated in all good faith as the best and most probable account that could be then given of God's universe." If this might have seemed upsetting to contemporaries, we should not forget that Goodwin's final conclusion brings us right back to Paley's natural theology:

He had seized one great truth, in which, indeed, he anticipated the highest revelation of modern inquiry—namely, the unity of design of the world, and its subordination to one sole Maker and Law-giver.⁴⁵

But this was as late as 1860. Although Goodwin's essay testifies to the lasting

⁴² *After Thoughts*, pp.13,14.

⁴³ "On the Mosaic Cosmogony," pp.227-8.

⁴⁴ "On the Mosaic Cosmogony," p.252.

⁴⁵ "On the Mosaic Cosmogony," pp.252-53.

influence of Buckland's views,⁴⁶ many members of the cloth reacted long before this. In 1837-38, for example, the following reactions were triggered by the *Bridgewater Treatise*: Fowler de Johnstone, *A Vindication of the Book of Genesis Addressed to the Rev. William Buckland*, J. Mellor Brown, *Reflections on Geology Suggested by the Perusal of Dr. Buckland's Bridgewater Treatise*, Eretzsepher, *Remarks on Dr. Buckland's View of the Mosaic Creation*. Cockburn's pamphlet was perhaps the least acrimonious, although, of course, the sheer weight of the dignitary made him a formidable religious antagonist.

Such reactions must have been foreseen, and Lyell's impatience with the delayed publication of Buckland's *Bridgewater Treatise*⁴⁷ should be explained in these terms rather than in scientific ones. In a sense it was going to be the official refutation of scriptural geology presented by a clergyman in a *Bridgewater Treatise* to a non-professional public of fellow clergymen. What Murchison called "Bridge-over-the-water"⁴⁸ was in fact a courageous renunciation of Scripture in the face of Anglican orthodoxy. This is often forgotten when the difference between Buckland and Lyell as contenders of opposite theories is unduly magnified. As with Sedgwick and Whewell, Buckland shared more with Lyell as a scientist than he is often given credit for.

Buckland gave up his flood, but on the more important question of the recent appearance of man geologists all agreed. In his research on human remains Buckland stressed that the state of bones found in caves in the Mendip Hills "affords indications of very high antiquity; but there is no reason for not considering them postdiluvian."⁴⁹ In his chapter "Human Remains in Caves" in *Principles* Lyell likewise admitted that human bones might be found mixed with other material in one solid breccia, but pointed out that as the process is a fast one "it is not on such evidence that we shall readily be induced to admit [...] the high antiquity of the human race."⁵⁰ Thus Buckland can in turn refer to Lyell in *Geology and Mineralogy* to support

the important fact of the total absence of any vestiges of the human species throughout the entire series of geological formations. Had the case been

⁴⁶ It is interesting that Goodwin, in 1860, takes it upon himself to criticize Buckland's views in detail, while he cursorily dismisses Darwin's newly published views of earth history as "transmutation of species, an hypothesis not generally accepted by naturalists" (pp.215-16).

⁴⁷ Lyell writes to Fleming: "Buckland's *Bridgewater Treatise* is only promised to us at Easter. We are curious to know what he will do about his diluvial theory, and if I hear true he has more than once changed his plan. He told me, however, that his mode of reconciling Geology and Genesis in his *B. Treatise* had been approved of by the Oxford Professors of Divinity and Hebrew!" (January 7, 1835, *LLL* i.446).

⁴⁸ Lyell to his father, October 4, 1836, *LLL* i.473.

⁴⁹ *Reliquiae Diluvianae*, pp.164-5.

⁵⁰ *Principles* ii.227.

otherwise, there would indeed have been great difficulty in reconciling the early and extended periods which have been assigned to the extinct races of animals with our received chronology.⁵¹

This passage carries a note to some pages of Lyell's chapter on the recent origin of man. The last page Buckland refers to is where Lyell quotes Paley:

In our globe new countries are continually discovered, but the old laws of nature are always found in them: new plants perhaps, or animals, but always in company with plants and animals which we already know, and always possessing many of the same general properties. We never get amongst such original, or totally different modes of existence, as to indicate that we are come into the province of a different Creator, or under the direction of a different will. In truth, the same order of things attend us wherever we go.⁵²

The relevance of the passage for Lyell was no doubt Paley's authority which here allowed for a place for uniformity in natural theology. Having referred to the pages in *Principles* which finish with this quotation, Buckland could not have missed the point which Lyell made with it. Thus when he later quotes the very same passage from *Natural Theology* in *Geology and Mineralogy*,⁵³ he minimizes the difference between catastrophism and uniformity by making the former part of the economy of the latter. Similarly he writes that

The ultimate atoms of the material elements, through whatever changes they may have passed, are, and ever have been, governed by laws, as regular and uniform as those which hold the planets in their course. All these results entirely accord with the best feelings of our nature, and with our rational conviction of the greatness and goodness of the Creator of the universe.⁵⁴

Buckland shared some of Lyell's deistic approach in describing the course of nature.⁵⁵ Uniformity in *sensu lato* could be interpreted as a form of natural theology for the orthodox as well as a scientific principle for the catastrophist. William Whewell was to develop a similar thesis in *Philosophy of the Inductive Sciences* in 1840.

⁵¹ *Geology and Mineralogy* i.101

⁵² *Natural Theology*, p.296; *Principles* i.159.

⁵³ *Geology and Mineralogy* i.541.

⁵⁴ *Geology and Mineralogy* i.10.

⁵⁵ See Hooykaas, *The Principle of Uniformity*, p.192.

CHAPTER EIGHT

ADAM SEDGWICK: HOW MUCH GOOD MIGHT HE DO?

Although Sedgwick was Lyell's senior by twelve years, their geological careers run contemporary. Both dedicated themselves to the science towards the end of the second decade of the century.¹ Both had reached their fundamental ideas about the earth's crust by the end of the 1820s, and from that moment onwards both were major figures on the geological stage until their deaths in the 1870s. Both criticized Chambers' *Vestiges* and both lived through and commented on the controversy around Darwin's epoch making book. Still, they were very different men, and often opposed each other critically. Sedgwick held that Lyell lacked the quality of a true field-observer; Lyell lamented Sedgwick's inability to put his geological knowledge together in a great geological system. No friendship like the numerous ones between the members of the Geological Society ever sprang up between Sedgwick and Lyell although they had a great number of friends in common. They treated each other with respect, but Lyell's customary humour does not show in his letters to Sedgwick, and the latter's usual affection for his correspondents does not come through in his letters to Lyell. They were not congenial minds. They came from entirely different social environments. And, of course, Sedgwick was a clergyman-geologist.

Sedgwick's place in the history of geology is at least as important as Lyell's. In the catastrophist-uniformitarian question, he became the bulwark of orthodox directionalism against Lyell's uniformitarianism in the 1830s, against Chambers' transmutation in the 1840s, and against Darwin's evolution in the 1860s. His was also a permanent contribution to nineteenth-century natural theology.

Sedgwick's thorough inductive methods and the fact that he was not blind to errors of such advocates of natural religion as Paley or Buckland carried conviction. His geological discoveries came first and foremost; theology was not allowed to obscure or discredit scientific truth. That his conclusions in geology were different from Lyell's can be explained by their different methods. The incomplete knowledge of the fossil record, moreover—a fact which both authors often emphasized—did not allow either to be decisive. It is in later life, however, that we cannot help suspecting a profound influence of Sedgwick's religious duties on his scientific viewpoints. In fact, much of his

¹ Sedgwick was elected a member of the Geological Society of London in 1818, Lyell in 1819; see Gillispie, *Genesis and Geology*, p.85.

later career seems spent in an almost fanatical reaction to transmutation; Sedgwick's amazing aggression on this point well overshot its mark.

*

Sedgwick was born in Yorkshire in 1785. His father was the rector of the small town of Dent, where the boy grew up. The mathematician John Dawson prepared him for Cambridge University, and in 1807 he won a sizarship for Trinity College, which was followed by a fellowship three years later. Originally Sedgwick wanted to read for the bar, but his acceptance of the fellowship meant a clerical profession. He obtained his Master of Arts in 1811.

That he was not very much inclined to the clerical profession becomes clear from his slowness in, and reluctance to follow theological studies. In a letter to his friend and fellow student William Ainger, written in 1811, he admits that he "has not taken the trouble to look for" questions in divinity, and as much as four years later it appears that he had not started yet, as he announces to the same: "on Monday I shall begin to read divinity."²

In the meantime he had been offered a curacy, which he declined. The statutes of Trinity College, however, decreed that all fellows had to be ordained within seven years after obtaining their Master of Arts. This left Sedgwick no possibility but to enter the Church. He was ordained deacon by Bishop Bathurst of Norwich in 1817, but remained at Cambridge as a tutor.

The tuition system of Cambridge exhausted Sedgwick—"I am most heartily sick of my connexion with the tuition"³—and when the Woodwardian chair of geology fell vacant upon the resignation of John Hailstone, he aspired to the professorship. His frequent attacks of ill-health dictated a life spent as much out of doors as possible. The Woodwardian Chair seemed to offer this.

Another candidate was George Cornelius Gorham, who seems to have had all the qualifications for the post; he had "been studying Geology for a long time" while Sedgwick had hardly any geological knowledge at all. Sedgwick, however, was nominated. Gorham commented bitterly on Sedgwick's likely nomination: "I feel a conviction that few persons in the University have followed up the Science more sedulously than I have. If, therefore, the Electors choose to dispose of Woodward's funds upon the shameful principle of *influence against quality*..."⁴

As a boy Sedgwick had spent most of his time out of doors, and in his early

² June 10, 1811, in *LLS* i.111; March 30, 1815, in *LLS* i.134.

³ Letter to William Ainger, March 19, 1818, in *LLS* i.153.

⁴ Gorham to his father, May 17th, 1818, in *LLS* i.157. Sedgwick, however, never saw Gorham as a serious rival. In the MS of his contemplated autobiography he records that when Evans, another candidate, retired, he "left the field virtually open for me." (Cambridge University Library: Class Mark Add. 7652 III.H.2, p.38; quoted with permission of the Syndics of Cambridge University Library).

teens had been entrusted with a gun. Shooting remained his favourite pastime till he substituted it for geology in 1817.⁵ Although in later life Sedgwick told J.W. Salter how as a boy he collected fossils from the limestone formations while nutting in the woods around Dent, geology does not seem to have interested him much until he was nominated to the Woodwardian chair at Cambridge. Even his journals written during a tour in the Swiss Alps are remarkably devoid of geological observations.⁶

Sedgwick, however, did not intend to occupy the chair vainly.⁷ In 1818 he was elected fellow of the Geological Society of London, in 1819 he explored Suffolk, Somerset, Devon and Cornwall and in the next year published his first geological research. Out of his regularly given lectures grew a syllabus, published in 1821 and revised in 1832 and 1837.⁸ Notwithstanding Gorham's grumbling, Sedgwick soon became one of England's leading geologists.

Sedgwick's early geological ideas were formed by Werner's geognosy. Soon, however, he discarded these ideas, as he humorously records: "For a long while I was troubled with water on the brain, but light and heat have completely dissipated it."⁹ A contemporary annotated copy of the 2nd edition of the *Syllabus* (1832) sheds some light on the works of geology Sedgwick deemed important for a study of geology. Robert Birkett, fellow of Emmanuel College from 1832 to 1851, wrote the following remarks in pencil on the back of the cover; their position seems to indicate that they were recommended by Sedgwick to his students during the first lecture of his course:¹⁰

Lyell's Geology Vol I specially
De la Beche—(dry)
Bakewell for a beginner
Cuvier's Theory of the [earth] by Jameson
Parkinson's Synoptics of Organics
Deshayes "

⁵ LLSi.49,152.

⁶ See LLSi.50,148.

⁷ In the MS of the autobiography Sedgwick writes: "The objects I proposed to myself [upon obtaining the Woodwardian chair] were as follows: To get a good collection together for study and reference[.] To get a Museum built to contain it [.] To give an annual course of lectures embodying all the known facts of the rising science of geology" (Cambridge University Library: Classmark Add. 7652 III.H.2, p.39; quoted with permission of the Syndics of Cambridge University Library).

⁸ "On the Physical Structure of those formations which are immediately associated with the Primitive Ridge of Devonshire and Cornwall" in *Transactions of the Philosophical Society of Cambridge* (1820, i.89-146); *A Syllabus of a Course of Lectures on Geology*, (Cambridge, 1821), henceforward *Syllabus*.

⁹ LLSi.284-5. In the outline of his never published autobiography Sedgwick dates his conversion in 1822 (Cambridge University, Classmark Add. 7652 III.H.2, p.44; quoted with permission of the Syndics of Cambridge University Library).

¹⁰ Interleaved copy of *Syllabus* (1832) annotated by R. Birkett, Emman: Coll., possessed by Cambridge University Library (Classmark Cam.c.832.7; quoted with permission of the Syndics of Cambridge University Library); this copy also contains at the back of the interleaved page after page 57 a humorous caricature in pencil of Sedgwick lecturing.

The first edition of the *Syllabus* shows that Sedgwick had already an adequate grasp of geology by 1821. He puts a certain emphasis on the study of the agents which are still modifying the earth's crust to explain the past, and the importance he attaches to organic remains rather than to mineral composition for the identification of strata shows his already modern geological outlook. That in the early 1820s he was ahead of his time in this is illustrated by the apparent need to repeat the importance of organic remains in dating strata to members of the Geological Society of London in 1830:

Each succeeding year places in a stronger point of view the importance of organic remains when we attempt to trace the various periods and revolutions in the history of the globe [...] The great barriers, which the fancy or ingenuity of geologists has at different times set up between the mineral productions of successive periods have been thrown down, one after the other. I do not deny the importance of mineralogical characters; I only mean to assert that taken by themselves, they are no certain indications of the age of any deposit whatsoever.¹¹

A year later he told the members again that "we have some new and striking proofs of the great importance of organic remains."¹² It confirms his complete renunciation of Wernerian methods of relative dating.¹³

Of the reality of the deluge and the recent appearance of man, Sedgwick still remained convinced. In 1825 he actually published an article in which he maintained that the facts of geology, independently from the inferences from the Mosaic account, prove a recent diluvian catastrophe on the surface of the earth. Nor has Buckland or any other serious geologist, he argues, "rashly" speculated on the perfect accordance between the discoveries of science and the truths of revelation, although there exists

a general coincidence which it is impossible to overlook, and the importance of which it would be most unreasonable to deny. The coincidence has not been assumed hypothetically, but has been proved legitimately, by an immense number of direct observations conducted with indefatigable labour, and all tending to the establishment of the same general truth.¹⁴

Like most other serious geologists, however, he had soon to give up his belief in the flood. In 1831 he published his famous recantation of his former diluvian theories. As the passage is characteristic of Sedgwick's philosophical honesty, it deserves quotation in full:

We saw the clearest traces of diluvial action, and we had, in our sacred histories, the record of a general deluge. On this double testimony it was, that we gave a

¹¹ Presidential Address (1830), p.204.

¹² Presidential Address (1831), p.295.

¹³ In 1850 he attacks Lorenz Oken's theory of physio-philosophy in which he finds resemblance to parts of Werner's geognosy; he remarks: "but who would think of printing such nonsense now?" (*A Discourse on the Studies of the University* (1850), p.237).

¹⁴ "On Diluvial Formations," pp.34-5.

unity to a vast succession of phænomena, not one of which we perfectly comprehended, and under the name diluvium, classed them all together.

To seek the light of physical truth by reasoning of this kind, is, in the language of Bacon, to seek the living among the dead, and will ever end in erroneous induction. Our errors were, however, natural, and of the same kind which led many excellent observers of a former century to refer all the secondary formations of geology to the Noachian deluge. Having been myself a believer, and, to the best of my power, a propagator of what I now regard as a philosophic heresy, and having more than once been quoted for opinions I do not now maintain, I think it right, as one of my last acts before I quit this Chair, thus publicly to read my recantation.

We ought, indeed, to have paused before we first adopted the diluvian theory, and referred all our old superficial gravel to the action of the Mosaic flood.¹⁵

In 1829 Sedgwick went on a trip to Italy which helped to undermine his belief in the diluvian theory. A meeting at the Geological Society was closed by Sedgwick “with a terribly anti-diluvialist declaration.” This was a good point for Lyell’s theory, who writes in jubilant words to Fleming: “he [Sedgwick] has come round, and is as decided as you are.”¹⁶

Sedgwick’s recantation illustrates his lifelong stance that scientists should not call in religion as the handmaid of geology, nor should the theologian argue from geological facts to prove the historicalness of the Pentateuch. Doing so harmed both science and religion. Sedgwick’s position is very much the same as Lyell’s in trying to free geology from Moses. The historian should, therefore, not take Lyell’s words for it that his was very much a one-man crusade against the mosaicists; Lyell had one of the ablest rhetoricians and most prestigious clergymen on his side. The following discussion of Sedgwick’s war against scriptural geology takes away much of Lyell’s heroics in the controversy as related in his correspondence. Sedgwick’s position as a member of the cloth made him much more vulnerable to attacks of the pious, but he never flinched from a debate and usually came out victor.

Sedgwick’s war on Moses starts in his Presidential Address to the Geological Society in 1830, where he condemns Ure’s *New System of Geology*—which Lyell had already derided in a letter in 1829¹⁷—by writing that it is by such “monuments of folly” that geology is disfigured:

to seek for an exposition of the phænomena of the natural world among the records of the moral destinies of mankind, would be as unwise, as to look for rules of moral government among the laws of chemical combination. From the unnatural union of things so utterly incongruous, there has from time to time

¹⁵ Presidential Address (1831), p.313.

¹⁶ 10 June 1829, *LLL* i.254. A few months later Lyell wrote: “Sedgwick and Murchison are just returned, the former full of magnificent views. Throws overboard all the diluvian hypothesis; is vexed he ever lost time about such a complete humbug,” (letter to Fleming, October 31, 1829, *LLL* i.256).

¹⁷ *LLL* i.238.

sprung up in this country a deformed progeny of heretical and fantastical conclusions, by which sober philosophy has been put to open shame.¹⁸

Ure's Mosaic geology forced the biblical story *a priori* on geological investigation out of a fear of discrediting the sacred records. Such an approach was to Sedgwick both unprofitable as a scientific principle and needless as a religious safe-guard. The naturalist should never fear the results of his inquiries

provided they be followed in the laborious but secure road of honest induction. In this way we may rest assured that we shall never arrive at conclusions opposed to any truth, either physical or moral, from whatsoever source that truth may be derived.¹⁹

Clearly, science and religion presuppose different methods of investigation, but the scientist shall not feel surprised if his findings confirm the sacred records:

truth must at all times be consistent with itself. The conclusions established on the authority of the sacred records may, therefore, consistently with the soundest philosophy, be compared with the conclusions established on the evidence of observation and experiment; and such conclusions, if fairly deduced, must necessarily be in accordance with each other.²⁰

Thus, in the pursuit of his favourite science, Sedgwick sees his discoveries as glorifying the grand quest for truth, and as such his method agrees with the postulates of natural theology.

*

In his first edition of *A Discourse on the Studies of the University* (1833)—a sermon delivered at the annual Commemoration of Benefactors in Trinity College, amplified in later editions with a huge preface and an oversized appendix—Sedgwick sees natural science as tracing the finger of God in all things animate and inanimate. He outlines the work of the geologist as the unravelling of the vast physical revolutions to which the globe itself provides the index. Sedgwick's assumptions shed much light on the interaction between natural theology and modern geology at the time.

Sedgwick divides his discussion of the studies at the university into three branches: (1) inductive philosophy, (2) ancient literature, (3) metaphysics, ethics and moral philosophy. Of the study of the inductive sciences, he writes that it is mainly a process of decipherment of "the records of creation in a strange, and to many minds, a repulsive language." But Sedgwick hastens to

¹⁸ Presidential Address (1830), p.207.

¹⁹ Presidential Address (1830), p.207.

²⁰ "On Diluvial Formations," p.34.

assure the reader that this language, once learnt, “becomes a mighty instrument of thought,”²¹ because it will lead to the conclusion that all the parts of the universe are “knit together by the operation of a common law,” which, if followed into its furthest consequences, is proof of “beauty, and harmony, and order.”²² Having established this, Sedgwick continues that these premises cannot but lead to the argument from design and the existence of a designer. The philosophical basis of this conclusion is weak. Sedgwick equates order with contrivance, and contrivance with design. He makes clear that with design he has an “intelligent superintending power” in mind. Thus, he might be accused of a foregone conclusion.²³ But then, Sedgwick does not set out to prove the existence of God to the non-believer, but rather wants to enhance the divinity in the eyes of the believer by looking for evidence of what is already taken for granted:

Should any one deny conclusions such as these, I can only reply that his mind is differently constituted from my own, and that we have no common ground on which to build a reasonable argument.²⁴

Completely in line with this train of thought, he next expounds on the importance of a habit of thinking in terms of natural theology which “produce[s] a cheerful sobriety of thought most favourable to the reception of sound religious impressions”²⁵ and admits that natural theology can add nothing to the believer’s strength of conviction of God’s being and providence, but that it is nevertheless truly compatible with the “highest devotional feeling.” In the Appendix he makes this position as unequivocal as possible: “the Christian makes them not the foundation of his faith. He seeks them not because he doubts, but because he believes.”²⁶ Moreover, pushed to the extreme, Sedgwick emphasizes that it is only the inborn religious capacity of man to conceive of the creator which gives the argument from design force and conviction; even Scripture itself is credible only on the very same grounds:

What knowledge could mere sounds like these convey through the ears to the heart, were there not already placed within it some knowledge of the being of a God; or at least were there not in the soul some natural and inborn power of rising

²¹ *Discourse* (1833), p.9.

²² *Discourse* (1833), pp.12-13.

²³ Cf. Thomas McPherson’s philosophical study of natural theology in *The Argument from Design* (1972): “A teleological argument to God is a line of thought that tends to see the universe as the field of purposive action: with this we are half-way to God already. An argument from design may be the same” (p.9).

²⁴ *Discourse* (1833), p.22.

²⁵ *Discourse* (1833), 88. Cf. also McPherson’s conclusion about the Paleyan school of natural theology: “The value of the Argument for them lies in its power to confirm belief, not create it, and in its power to set up a habit of mind, suitable for religious believers, in which there is a disposition to see design in the things about them” (*The Argument from Design*, p.72).

²⁶ *Discourse*, (1833), p.92.

to the apprehension of a general religious truth when presented to it in the form of a mere abstraction?²⁷

Man brings a religious predisposition with him in his approach to natural theology. This is clearly along Paleyan lines. Paley had argued that the argument from design makes the world “a temple, and life itself one continued act of adoration [...] we can now scarcely look upon any thing without perceiving its relation to [God].”²⁸ Even if we do not fully understand the divine process, Sedgwick writes, we do understand the adaptation of various mechanisms to their ends, which is “enough to warrant our conclusion.”²⁹ His argument here again runs parallel to Paley’s watch analogy, who emphasized that it would not “bring any uncertainty into the argument, if there were a few parts of the watch, concerning which we could not discover, or had not yet discovered, in what manner they conduced to the general effect [...] The indication of contrivance remained.”³⁰ “It is not necessary to know all this to be certain of an intelligent contriver,” Sedgwick echoes.³¹ In a long note on this section, Sedgwick moreover mentions the superiority of Paley’s work over similar attempts in natural theology and partly in his honour “endeavour[s] to add one or two familiar examples [...] at the risk of extending this note to an unreasonable length.”³² Psalm 139 asserts that natural religion is warranted by the Bible itself and that “the religion of nature and the religion of the Bible are therefore in beautiful accordance.”³³

Through such reasoning Sedgwick reaches the science of geology, which “like every other science when well interpreted, lends its aid to natural religion.”³⁴ In this new science “we learn that the manifestations of God’s power on earth have not been limited to the few thousand years of man’s existence.”³⁵ This, however, does not clash with our notion of the Creator, as the repeated change in external conditions proves that he has always been actively present both in his own person and through providence. Sedgwick keeps complete silence here on the obvious discrepancy between the scriptural and geological age of the earth, on which he was to be attacked by another clergyman, Henry Cole.

Although Sedgwick does not want to explore the issues of modern geology at greater depth, he points out that in tracing the changes of previous eras, the geologist finally reaches a state without organic life—“the dark age of nature’s

²⁷ *Discourse*, (1833), p.92.

²⁸ *Natural Theology*, p.354.

²⁹ *Discourse* (1833), p.9.

³⁰ *Natural Theology*, p.3-4.

³¹ *Discourse* (1833), pp.19-20.

³² *Discourse* (1833), p.89.

³³ *Discourse* (1833), pp.15-16. Sedgwick quotes as proof from Psalms 139:1-12.

³⁴ *Discourse* (1833), p.22.

³⁵ *Discourse* (1833), p.22.

history”—which seems to point to a beginning. He firmly concludes that “if we cannot point out the first traces of organic life, we can find, at least, an indication of its beginning.”³⁶ This passage runs diametrically against the Huttonian motto that there is no suggestion of a beginning, a theory which was discussed in his lectures.³⁷ Similarly Sedgwick also wanted to take the wind out of the sails of atheistic speculations on the evidence afforded by geology: “[such indications of a beginning] take from nature that aspect of unchangeableness and stern necessity which has driven some men to downright atheism, and others to reject all natural religion.”³⁸ He might have thought of Toulmin, whose book was still popular in the mid-1820s. The ultimate importance of natural theology for Sedgwick was that it teaches man not only God’s wisdom and power, but above all his goodness. As he saw that everything in existence had a purpose, he could not believe that in the end there was only “a cold and dismal region, where our eyes behold none but the appalling forms of nature’s dissolution,” he could not “believe that a God of power and wisdom will deceive him.”³⁹ Thence man gets his hope for future glory.

The *Discourse* has a sting in its tail for Mosaic geologists, who “have committed the folly and the sin of dogmatizing on matters they have not personally examined.”⁴⁰ He again stresses that natural philosophy does not lead to the truths of revealed religion, nor do the truths of religion lead to the conclusions of inductive science. The Bible is a rule of life and faith, and does not concern itself with history before the creation of man. The geological eras do not belong to our moral history and therefore do not come within the spirit of revelation.

There is nothing in these assertions that Sedgwick had not urged before. But when he next writes a defense of the religious sentiments of the geologists, it becomes clear that something has changed in the popular opinion. During the late 1820s and 1830s, in fact, scientists were increasingly attacked for the immoral tendencies of their discoveries. Although Sedgwick disdains to argue with such accusers, the reputation of the geologists needed to be cleared. “The living philosophers of this country,” Sedgwick emphasizes, “are a set of sober-minded men, who have betrayed no hostility to revealed truth [...] but many of them are men of pure lives and firm believers in revelation.”⁴¹ With this statement Sedgwick confirms that the geologists of the time were far from

³⁶ *Discourse* (1833), p.25.

³⁷ The first and second editions of the *Syllabus* (1821 and 1832 respectively) included, amongst others, reference to Werner and Hutton (1821: p.45; 1832: p.57) which remained virtually unchanged in the 1837 edition. As the syllabus is only a rough outline of the course, we have only the headings of the different parts of Sedgwick’s course, not the contents.

³⁸ *Discourse* (1833), p.24.

³⁹ *Discourse* (1833), p.27.

⁴⁰ *Discourse* (1833), p.106.

⁴¹ *Discourse* (1833), p.107.

seeing their science as irreligious, and explains the panic once they were caught unawares by the atheistic tendencies to which their facts seemed to lead after all. This position is symptomatic of Lyell's stand too, who agreed with most other geologists on both the postulates of science and of religion.

As the gap between the professional geologists and public opinion widened during the 1830s, Sedgwick and Buckland, because of their ecclesiastical positions, were increasingly taken to task. In 1834 the Rev. Henry Cole, a bigoted mosaicist who was entirely unacquainted with geology proper, published a lengthy pamphlet in reaction to "the Geologist's monstrous pre-creation histories and speculations" in which he denounces Sedgwick's *Discourse* as "the greatest presumption in a fallen and fallible mortal,—and the most dangerous instruction from a minister of divine Revelation."⁴²

The pamphlet is a good example of the hysterical language used in some of the reactions against the "revelation-subverting philosophy of this "new science," which is now spreading its perverting and baneful influence on all sides [...] namely, that the globe on which we live was created many thousands of years before man was created upon it."⁴³ Sedgwick, he writes, poses as if he knew more of the earth than Adam and the patriarchs, who were much nearer in time to the moment of creation:

the Rev. Adam Sedgwick, in the fifty-ninth century of the world, has, by the wonders of the "new science," discovered more of the works of God in the Creation, than Adam knew when he came, in the perfection of knowledge, from the hand of his Maker.⁴⁴

Sedgwick's dating of the earth is based on weak criteria: the datableness of any deposit is "beyond the limits of mortal ability," chronology depends very much on the school of geology, and the indices furnished by strata are but "bare hypothetical supposition[s]."⁴⁵ The "baseless philosophy of the Rev. Adam Sedgwick" is contested by Cole in his insistence that the Bible is the only and true source for the history of man and the world. The ranting quality of the following passage is characteristic of most of his writing:

Sir, deeply and sacredly remember, that they [the scriptures] *do* pretend to be, and *are designed to be* A REVELATION OF THE CREATION OF THE WORLD! With that Revelation the Book of God opens; and there is the express design of the Creator that there never should be any other.⁴⁶

Sedgwick's warning against a literal interpretation of the Scriptures in the appendix of the *Discourse* and his admission of having experienced the

⁴² *Popular Geology Subversive of Divine Revelation*, p.52.

⁴³ *Popular Geology*, pp.v-vi.

⁴⁴ *Popular Geology*, pp.56-59.

⁴⁵ *Popular Geology*, pp.85-88.

⁴⁶ *Popular Geology*, p.80.

impossibility of interpreting geological epochs as the days in the narrative of Moses

involves in it an awful view of the Geologist's determined rejection of divine Revelation, where it crosses the dreams of the "new science," and of his resolution to push his man-applauded enquiries in the face of divine Veracity itself.⁴⁷

And this, Cole concludes, "is the cloven foot of the drift of Geology." Such a condemnation goes far beyond any accusation brought against Lyell and was the more dismaying as Sedgwick, like Buckland, after all, set out to show "the marks of skill and wisdom" of the Creator.

Although Sedgwick did not stoop to so mean an opponent,⁴⁸ William Cockburn, Dean of York, proved a more formidable antagonist. Cockburn, as we have seen, had already maintained in 1838 the veracity of Moses against Buckland in his *Letter to Professor Buckland, Concerning the Origin of the World*. During the 1844 meeting of the British Association in York, the Dean had a golden opportunity to present his objections to the Geological Section. In his paper read on 27 September 1844, Buckland was again his butt. He pointed out the baselessness of the history of the earth as given in the *Bridgewater Treatise* and then presented a theory of his own—later developed in his *New System of Geology* (1849)—in which he advocated that "every thing in the world was made at one time; nothing has been added, nothing taken away." Without referring to the divine fiat of creation, he builds up an explanation which to the uninitiated might have seemed satisfactory. It is at the end of his discourse that he almost casually remarks:

You will of course perceive that my theory accords precisely with the account given by Moses. I do not however press it upon you in consequence of that accordance, but because I contend that every modern discovery may be accounted for by this theory, and cannot be accounted for [by] the theory of Dr. Buckland.⁴⁹

Not surprisingly, the geologists present hailed the paper with laughter.⁵⁰ An unpublished anonymous poem glued by Sedgwick in the copy Cockburn sent him in 1849 of his *New Geology* describes the impression the Dean created at the meeting. It runs as follows:

His Bible's defence
Shows the Dean's want of sense
And Buckland & Sedgewick [*sic*]

⁴⁷ *Popular Geology*, p.77.

⁴⁸ A rejoinder to Cole's pamphlet, however, can be found in the 5th edition of the *Discourse*, published more than fifteen years later. In it Sedgwick simply dismisses Cole's criticism as "nothing better than the dreams of a disordered imagination" (p. 133). See also *Discourse* (1850), pp. 139-141.

⁴⁹ *The Bible Defended against the British Association*, p. 15; all references are to the fifth edition (1845).

⁵⁰ *Edinburgh Journal*, II (1844), p.322.

Have wapp'd him with hedgestick
 And tho' he supposes
 He's a great friend of Moses
 His proceedings appear
 To demonstrate clear
 That Moses & He
 Can never agree
 For one was quite silent on things
 that he knew not
 T'other sticks to his folly,
 like a fly in a glue pot.⁵¹

Still, Cockburn's style—balanced, elegant and genteel—was such as to make it altogether different from Cole's. He enjoyed great popularity with the publication of his paper, which appeared as *The Bible Defended against the British Association* immediately after the meeting and ran through four editions during the rest of 1844. The fifth edition of 1845 was appended with the correspondence the Dean had had with various members of the British Association.

It was Sedgwick who replied during the meeting to Cockburn's paper with "a scornful bitterness beyond the power of any reporter to reproduce."⁵² He attacked the Dean on his ignorance of geological knowledge,⁵³ and repeated what he had already written in his *Discourse*, namely that "truth could not be opposed to itself, and [that...] the highest discoveries of science would ever be found in perfect harmony and accordance with the language and meaning of revelation."⁵⁴

The matter did not end here. Cockburn wrote to Sedgwick on the very day of his defeat at the meeting, requesting him to explain step by step the origin of the earth from its nebulous to its present state. Sedgwick declined to answer. Next, Cockburn wrote to Henry Warburton, who had presided over the Geological Section of the British Association, asking for a second discussion of his paper. D.F. Ansted answered for Warburton that there existed no precedent for such a proceeding. In the meantime, Sedgwick had written a short note in which he "insists upon the long antiquity of the world, which he conceives to be proved by unassailable evidence."⁵⁵ Cockburn, as can be imagined, answered by return of post, complaining that his "great objection to

⁵¹ The poem glued in Sedgwick's copy of *A New Geology*, possessed by Cambridge University Library, class-marked Cam.d.849.4, is commented in Sedgwick's hand as "This elegant scrap was sent to [me] at the York meeting of the British Association after my battle with the Dean. 1844 AS" (quoted with permission of the Syndics of Cambridge University Library).

⁵² Comment of an eye-witness quoted in *LLS* ii.78.

⁵³ See letter of Cockburn to Sedgwick, 27 September 1844 as quoted in *The Bible Defended*, pp.16-18.

⁵⁴ Reported in *The Athenaeum*, quoted in *LLS* ii.79.

⁵⁵ Reported by Cockburn (Sedgwick wisely refused his letters to be published), *The Bible Defended*, p.21.

the geologists is that though we allow them millions of ages, their system can find *no beginning*.”⁵⁶ It is interesting to note that Sedgwick here is called upon to defend what he had criticized in Lyell’s theory. By October 29th Cockburn had received a long explanatory letter from Sedgwick, but Sedgwick did not want to see it published. Cockburn’s next step was a letter to Murchison, then President of the Geological Society of London, to request an open discussion with the Society on the age of the earth. Murchison declined. A subsequent letter to Buckland only prompted a note declining to offer arguments for the age of the earth. Sedgwick in the meantime had announced the impossibility of further correspondence. Cockburn carefully construed from this series of letters the unwillingness on the part of the geologists to meet his arguments and concludes that they are “fearful of exposing themselves” because their theories are “idle suppositions and irrelevant facts.”⁵⁷

Although in his *Discourse* Sedgwick had admitted the impossibility of making geological facts square with Scripture, and although he declined to answer Cole and Cockburn on these questions, in a letter to an unnamed friend he tried his hand at reconciling the Pentateuch with geological facts as late as 1844.⁵⁸ The first two verses of Genesis, he writes, are a mere exordium of God’s creative powers “at a period so immeasurably removed from man as to be utterly out of the reach of his conception.” Like Buckland, he finds a gap between the initial affirmation of God’s power in the first verse and the beginning of the creation, in which he “would place the periods of our old geological formations.” The second verse “may perhaps describe the condition of the earth after one of the many catastrophes by which its former structure had been broken up, and of which we can, on its present surface, find so many traces,” out of which God moulded the existing state of the earth in six figurative days. All the same, Sedgwick recognized the mere speculative nature of this interpretation. The description of Genesis 1:1-2 is too “short and mysterious” to confirm or refute geological theory. Obviously a complete account of the origin of things lies outside the “scope of revelation [...] because [it is] unconnected with the moral destinies of man.”⁵⁹ It seems that, although Sedgwick did not approve of Buckland’s natural theology, he did espouse his exegesis of Genesis. Like Buckland he insisted on a proper approach to science and religion:

If we believed, as we did believe, that the Author of Nature allowed us to call Him Father, and that He called us children, and that He gave us hope of a heavenly hereafter, let us also believe, at the same time, while obeying those instincts

⁵⁶ *The Bible Defended*, p.21.

⁵⁷ *The Bible Defended*, pp.38,40.

⁵⁸ *LLS* ii.79-80; the letter was written in 1844-45.

⁵⁹ Cf. “[the Bible is] intended only to be a guide of religious belief and moral conduct” (*Geology and Mineralogy* i.13).

which He has implanted in our bosoms, and reading the records of His will as written in the solid framework of the earth, or in the glittering phenomena of the sky, or in what the broad generalisations of science had manifested, that these two kinds of truth, embodied in physical history and revealed religion, so far from being conflicting, were entirely in unison and harmony, if we investigated the one, and read the other, in a right spirit.⁶⁰

To Sedgwick, therefore, reconciliation of science with religion at the present state of knowledge was premature. This assertion shows that he shared Lyell's caution and Buckland's insistence that geology was as yet an "infant science." In a letter to Mrs Cropper, who had written to the Cambridge professor on behalf of a friend and clergyman who wanted in a course of popular lectures to reconcile geology and Scripture, Sedgwick warns that "several clergymen have made similar attempts, and committed themselves to assertions some of which I think incorrect as to fact, and inconclusive as to argument." The danger, he continues, lies in the tendency of the public to find fault in "the Mosaic record, and not in the ignorance of the lecturer." He records how he himself had once agreed with Buckland on the geological proof of a recent deluge which conformed with the Mosaic account and that his early notions of distinct "former worlds" had had to be refuted too.⁶¹ Sedgwick concludes his letter to Mrs Cropper with the honesty characteristic of so much of his writing: he admits that those are "points respecting which I do not profess to see my own way very clearly." Still, it is not to be supposed that geological discoveries unsettled Sedgwick's faith. He has "no fear about the ultimate result;" geology has already done much good for religion: the "knights of the hammer" have shown that the earth is not eternal and was therefore created by an external power who ordained "all laws by which the order of nature is maintained," that this power "has been employed again and again in replenishing and renovating the earth," that land and sea have often changed place so that a "historic deluge is not impossible or improbable," and that man is of recent origin.⁶²

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In 1832 Lord Chancellor Brougham offered Sedgwick a prosperous living in Kent, which was declined because Sedgwick thought it would interfere too much with his geological projects. He lost a golden opportunity here, as Lyell, who was often jealous of Church preferment for geologists, aptly commented:

He told me, Thursday last, that he wished before he left Cambridge to do something. 'Now if I take a living instead of going to Wales, I abandon my Professorship, and cannot get out the volume on the primary rocks with

⁶⁰ *The Suffolk Chronicle*, December 16, 1848, quoted in *LLS* ii.150-1.

⁶¹ June 5, 1858, *LLS* ii.343.

⁶² *LLS* ii.344.

Conybeare,' etc. Then he hinted that in a year, when this is done, he may retire on some living, and marry. But I know Sedgwick well enough to feel sure that the work won't be done in a year, nor perhaps in two; and then a living, etc. won't be just ready, and he is growing older. He has not the application necessary to make his splendid abilities tell in a work. Besides, every one leads him astray. A man should have some severity of character, and be able to refuse invitations, etc. The fact is that to become great in science a man must be nearly as devoted as a lawyer, and must have more than mere talent.⁶³

Lyell's assessment of Sedgwick's abilities as a writer seems justified by Sedgwick's own complaints about his physical ailments when writing; the following is a typical example of the many excuses in letters to his friends: "Could I command my stomach, I could clear off my work easily enough; but the moment I try to employ my pen, all the inner man gets out of order, and then, as for brain, my head might just as well be filled with brick-dust."⁶⁴

Brougham's offer had clearly been an offer to help a friend, and in 1834, just before resigning office, he offered Sedgwick a prebendary stall at Norwich. This time the offer was not to be refused. It was a welcome addition to his inadequate Cambridge income and moreover would, Sedgwick thought, interfere only minimally with his professorship, as he, as one of the six prebendaries, was supposed to be resident in Norwich only two months a year. The months which were assigned to him, December and January, suited Sedgwick well, as the greater part of these two months fell in the Cambridge Christmas holidays and were poor months anyway for geologizing. His religious duties in Norwich, however, were to have profound repercussions on his geological work and ideas.

Although Lyell was sympathetic to Sedgwick's case in the letter above, in a later, more grumbling letter he criticized the negative influence of church preferment on the progress of science. Although not daring to be as outspoken as he was about Henslow, he firmly held that Sedgwick had neglected his Geology Chair at Cambridge "or was less efficient when resident Canon at Norwich."⁶⁵ Again, Lyell was probably justified here as well, although his own precarious financial situation might have prompted the rather jealous tone of the letter. Sedgwick, who had declared upon receiving the stall that he did not mean to flinch from his duty,⁶⁶ was in fact more often diverted from his geological pursuits than he initially had envisaged. In a letter to Murchison, Sedgwick complained that the "long services cut my time to shreds, and destroy the spirit of labour."⁶⁷

Sedgwick's predominantly geological interests provoked criticism of his

⁶³ Journal to his future wife, *LLL* i.375.

⁶⁴ Letter to William Ainger, November, 20, 1836, *LLS* i.466.

⁶⁵ Letter to John Fleming, February 6, 1856, *LLL* ii.208.

⁶⁶ Letter to William Ainger, December, 15, 1834, *LLS* i.435.

⁶⁷ January, 25, 1837, *LLS* i.439.

religious duties too. His friend and colleague prebendary Charles Wodehouse reminded him in October 1837 of a plan for a course of sermons to be preached at Norwich Cathedral and to be published afterwards. He urges Sedgwick “to throw aside other matters for a few weeks [...] and] give us some good, well-considered Theology from the Prebendal Chair.” His reputation was at stake, Wodehouse proceeds:

“Sedgwick won’t take the trouble to compose sermons,” say some. “He can’t”, say others. “He gives us nothing but a few scraps of paper written with a pencil in church, and he’ll teach all the young ones to do the same.” “If he really has not time to prepare properly a few sermons, why was he made a Prebendary?”

Although Wodehouse distances himself from these “waspy speeches” and admits that “you have done much for us here as a Geologist,” he cannot help asking himself: “How much good might he do if he would turn his talents this way, and give us every Residence a good course of good sermons?”⁶⁸

Wodehouse’s letter made Sedgwick “wince a little,” but his answer was a friendly but firm refusal. He writes that although the “waspy speeches” have not hurt him, he is willing to investigate whether he has neglected his clerical duties, as “ill-natured things are seldom said without some semblance of foundation.” But upon examination, he finds that he has actually done more than his share in prebendal work. Moreover,

some of my friends expect more from me than I can do. Because on some occasions I speak fluently, it by no means follows that I write readily. Experience tells me the very contrary. I write with pain to myself in every sense of the word, for a very few hours’ writing will generally bring on a fit of indigestion and swimming in the head, which puts an end to all rational continuity of thought.

Apologetic as most of his letter is, his final decision leaves the reader no doubt of his intentions:

were I to give myself up to theological studies exclusively no doubt I might do more than I have done. But it is at present impossible for me to do so. And were the alternative given me this day of resigning my professorship or my stall, because I could not do the duties of both properly, I should instantly give up the latter, and not the former.⁶⁹

His geological ideas from this point on, however, are increasingly tainted with theological prejudice, as if this attack on his sense of duty had indeed stung him to the quick.

⁶⁸ October 10, 1837, *LLS* i.496-97.

⁶⁹ October 12, 1837, *LLS* i.497-99.

CHAPTER NINE

ADAM SEDGWICK: THE SOBER FACTS AND THE ROGUE'S GAME

Sedgwick was elected President of the Geological Society of London for the biennium 1830-1831. Thus it fell to him to comment in his speech on retiring from the chair in 1831 on Lyell's just published *Principles of Geology*. We have already noted that Lyell felt pained by Sedgwick's conclusion that his scientific inductive methods were not sound. It is important to point out that there is no trace of the religious prejudice which Sedgwick later used against Chambers. Sedgwick picked on the weakness of Lyell's uniformitarian principle that "the physical operations now going on, are not only the type, but the measure of intensity of the physical powers acting on the earth at all anterior periods."¹ Lyell's steady-state system denied directional progression, a process of which Sedgwick found evidence everywhere in the book of nature. Years later in a letter to David Livingstone he commented on Lyell's shortcomings as a scientist:

He is an excellent and thoughtful writer, but not, I think, a great field-observer, and during his long geological labours he has never been able to look steadily in the face of nature except through the spectacles of an hypothesis. His mind is essential deductive, and not inductive. Now geologists have not yet sufficiently unrolled the records of the earth to reach a starting point of knowledge from which to reason deductively with perfect safety.²

This seems to be at the core of Sedgwick's major objection to *Principles*. In the passage of his Presidential Address leading up to his assessment of Lyell's book he sets out with the statement that geology is a science of observation. In this it compares unfavourably with astronomy, which is the kind of triumph in exact science that geology cannot ever hope for. Whereas in astronomy there is a closed set of mechanical elements, the phenomena of geology depend on such endless combinations and interactions of laws that the results are often contrary to expectation and are, therefore, not calculable mathematically. Although the laws of nature are constant—as they might reasonably be supposed to be because they come straight from the Creator—their combinations tend to create ever new situations. Any theory, therefore, based on stability in the system of nature "confounds the immutable and primary laws of matter with the mutable results arising from their irregular combination."³ And that,

¹ Presidential Address (1831), p. 304.

² March 16, 1865, *LLS* ii.412.

³ Presidential Address (1831), p.301.

according to Sedgwick, is the weakness of systems of uniformity: they do not distinguish between laws and the interaction of laws. It is true that the basis of geological observation must needs be the physical operations going on today in type—"we can only judge of effects which are past, by the effects we behold in progress"⁴—but to suppose that these powers have remained constant in intensity is unwarranted aprioristic reasoning.

Against Lyell's theory, Sedgwick opposes that in the complete disappearance of the earliest animal and vegetable forms we have "some indication of change and of an adjusting power altogether different from what we commonly understand by the laws of nature."⁵ Although Lyell's condemnation of progressive development is accepted by Sedgwick, this does not automatically make a case for an uninterrupted succession of events:

The appearance of man is a geological phenomenon of vast importance, indirectly modifying the whole surface of the earth, breaking in upon any supposition of zoological continuity, and utterly unaccounted for by what we have any right to call the laws of nature.⁶

Lyell maintains that there have been no violent breaks in geological continuity, but to Sedgwick the facts tell the opposite.

Of course, Lyell never maintained that catastrophes could not take place and argued for stability in the whole system of nature taken together: local catastrophes are "essential to the stability of the system," Lyell writes in *Principles*.⁷ To this Sedgwick replies rather peevishly: "let it not be said, that it is only in the greater combinations on the surface of the earth that we are to look for returning cycles. Great and small have no meaning, except in reference to us and our conceptions."⁸ William Whewell was to make a similar objection to Lyell's uniformity.

Sedgwick's verdict on Lyell's time-span is ambiguous. That there are no physical traces of a beginning is a "question of no real importance," Sedgwick admits, but reasoning on the uniformitarian principle of intensity to such a conclusion is not admissible. He is the first to admit that "of such an element as past time, we grudge no man the appropriation," but to argue for an "infinite succession of phenomena" is against the facts of observation.⁹ Astronomy indicates that the earth has the form of a fluid in rotation and geology shows that a gradual cooling down of the earth is undeniable; these are clear indications of a "primeval fluidity" before the beginning of true geological phenomena "in spite of one of the arbitrary dogmas of the Huttonian theory."¹⁰

⁴ Presidential Address (1831), p.304.

⁵ Presidential Address (1831), p.305.

⁶ Presidential Address (1831), p.306.

⁷ *Principles* i.479.

⁸ Presidential Address (1831), p.302.

⁹ Presidential Address (1831), p.305.

¹⁰ Presidential Address (1831), p.298.

It is true that Sedgwick's critique of Lyell's geological principles was severe, but otherwise the review was as warm-hearted as possible: he admits that he thoroughly enjoyed Lyell's book and that the "work has already taken, and will long maintain a distinguished place in the philosophic literature of this country."¹¹

On the whole, Sedgwick's appraisal of Lyell's method cannot draw forth admiration for its clarity and profundity, but his premises were understandable for a champion of honest inductive science. The deductive speculations of former generations of geologists had retarded the progress of the science, and Sedgwick was not likely to give up what he deemed so essential for science. He repeatedly stressed that it was the attitude of non-commitment to any system of geology that made the Geological Society so successful in 1818 (when he was elected one of its fellows).¹² But if one wants to insist on theory, then uniformitarianism is not more philosophically sound than catastrophism, and as the facts seemed to point to the latter, why not adopt the latter rather than the former? Moreover catastrophism was also more attractive to Sedgwick's religious preconceptions, as we can see from a letter written almost twenty years later in which his opinion of Lyell's philosophic principles seem unchanged. In 1849 he wrote to Hugh Miller about his then forthcoming fifth edition of *Discourse of the Studies of the University of Cambridge*:

I hold (against the Huttonians) that Creation had a beginning in time, and that this conclusion is based on inductive evidence: viz. that man is the last of the existing order of things, and that animal creations are not now going on, as Lyell seems to think probable. I have made this one of the links of an analogical argument in favour of Christianity.¹³

If Sedgwick would not accept the principles brought forward in Lyell's book, Buckland's natural theology in his *Bridgewater Treatise* fared no better. In a letter to William Daniel Conybeare, with whom he intended to write a handbook on geology, Sedgwick strongly objects to Buckland's method. The natural history is good, he admits, but the book contains too many details for the argument of natural theology: "he gives us a mere mosaic, without coherence, and a discontinuous string of quotations. I cannot bear such writing on such a grand occasion." Buckland's writing overstrains the argument of natural theology by dwelling too much on individual evil before coming to general conclusions about the total perfection of the system:

We can establish wisdom and benevolent design from the happy tendency of laws; so far the argument is direct. But in the working of the laws we find much particular and individual evil. If we argue *directly* we lead to the conclusion that

¹¹ Presidential Address (1831), p.302.

¹² For example: "[geologists] are not anxious to form any theory" (*Discourse* (1850), p.lxxviii).

¹³ September 3, 1849, *LLS* ii.161.

God wants benevolence, or wants power. But if we argue indirectly, we show (and this Buckland has done, though he has not put the argument well, and has overstrained it), that much good comes out of apparent ill, and that the evil on the surface of things may be resolved into something connected with our own imperfection and shortsightedness.

And he concludes that "as a book of Palaeontology it is very good, in parts admirable; as a book of Natural Theology it is not good." The "moral and theological part is, I think, a great failure."¹⁴

What Sedgwick objects to in the Bridgewater school of natural theology is the tendency to stress its all-sufficient pretensions which leave revelation out completely. This leads to a form of deism which in reality suffers the same shortcomings revelation is accused of by the deists. Joseph Butler's conclusions are final here:

Most young men who think for themselves have their moments of doubt, and I have known many who seemed to be seeking a resting-place in a calm philosophical deism; and on that shoal (or on something worse) they were almost sure to strike if they were men of licentious life. If I was ever drifting in that direction (and I hardly remember what my early dreams were), I was arrested in it by Butler, who proved to me that there was no refuge in deism—that it was encumbered with the same difficulties as revelation, and I never, save for a moment, so far belied my nature, as to doubt about the being of a provident God and Creator.¹⁵

Sedgwick refers to Butler's *Analogy of Religion, Natural and Revealed, to the Constitution and Course of Nature* (1736) in which the shortcomings of natural religion are compensated by revelation, and as such afford no "presumption" against miracles:

If we leave out the consideration of Religion, we are in such total darkness upon what causes, occasions, reasons, or circumstances, the present course of nature depends, that there does not appear any improbability for or against supposing that five or six thousand years may have given scope for causes, occasions, reasons, or circumstances, from whence miraculous interpositions may have arisen.¹⁶

And Butler concludes:

The whole, then, of religion is throughout credible: nor is there, I think, anything relating to the revealed dispensation of things, more different from the experienced constitution and course of nature, than some parts of the constitution of nature are from other parts of it.¹⁷

Sedgwick's alarm at Buckland's natural theology was not unjustified. The anonymous author of *The Vestiges of Creation*, was quick to pick up the

¹⁴ December 5, 1836, *LLS* i.470-71.

¹⁵ *LLS*, ii.299.

¹⁶ *Analogy*, p.140.

¹⁷ *Analogy*, p.251.

implications of Buckland's exaltation of "the consummate skill and power" of the creator in providing the elements with properties that "adapted them beforehand to the infinity of complicated useful purposes."¹⁸ The author of *Vestiges* proceeds by reducing God to a series of principles that rule existence: "The Eternal One has arranged for everything beforehand, and trusted all to the operation of the laws of his appointment, himself being ever present in all things."¹⁹ This takes the very direction in natural theology that Sedgwick had feared.

The writer of *Vestiges* was Robert Chambers, the Edinburgh publisher who ran the weekly *Chambers's Edinburgh Journal* with his brother. The two brothers wrote short articles on popular science, literature, folklore and antiquarian matters for a middle-class reading public. Although Robert Chambers was not a scientist, he was acquainted with the progress in most fields of science, and had a special interest in geology. With great journalistic skill and a tendency to generalize, he used his scientific knowledge to popularize science in his *Journal* for his readers. *Vestiges* was written for the same middle-class readership. Where most scientists of the time wrote for an intellectually sophisticated, though not necessarily expert, audience, Chambers aimed at the kind of synthesis that the average reader of his *Journal* longed for. He presented the whole of scientific discovery, from astronomy to phrenology, as confirming an underlying law of cosmic progress. Notwithstanding, or because of, some of its more fantastic notions, as, for example, the chemico-electrical generation of life out of dead matter, *Vestiges* was an immediate best-seller which remained popular until long after the publication of *The Origin of Species*.

Vestiges was indeed scientifically unsound, but Sedgwick did not limit himself to criticizing its scientific basis: he concentrated above all on the moral implications of the author's views. In a letter to Lyell, then President of the Geological Society, he exclaims:

The sober facts of geology shuffled, so as to play a rogue's game [...] Gross credulity and rank infidelity joined in unlawful marriage, and breeding a deformed progeny of unnatural conclusions! [...] If the book be true, the labours of sober induction are in vain; religion is a lie, human law is a mass of folly, and a base injustice; morality is moonshine; our labours for the black people of Africa were works of madmen; and man and woman are only better beasts!²⁰

Professional sympathy was likely to come from Lyell, who as President of the Geological Society, could use his power to denounce "the foul book." But Lyell was more careful and waited till 1851 to discard publicly the opinions advanced by its anonymous author.

¹⁸ Quoted in *Vestiges*, p. 82.

¹⁹ *Vestiges*, p. 96.

²⁰ April 9, 1845, *LLS* ii.83-4.

Sedgwick, however, joined the hysterical reactions to the *Vestiges* in 1845. Having initially refused the editor of *The Edinburgh Review*, Macvey Napier, to write a review of the book, Sedgwick soon regretted his decision—"I do from my soul abhor the sentiments and I believe I could have crushed the book by proving it base, vulgar in spirit, [...] false, shallow, worthless"—and throws himself with all his energy in the controversy to crush the book in a second instant. Sedgwick's sledge-hammer method even frightened Darwin, silently working on evolution in Downe, who admitted to Lyell, "I read it with fear and trembling."²¹

The anonymity of its author had become matter for speculation. Some pointed at Thackeray, some at the Prince Consort. Sedgwick seems to have had Harriet Martineau in mind: he condescendingly writes in his letter to Lyell of "the mesmeric dreamer, and economist in petticoats" and condemns phrenology as "that sinkhole of human folly and prating coxcombry."²² Sedgwick's choice was not a bad one, seeing Martineau's atheistic views in her letters to Henry Atkinson, published a few years later in 1851, in which she asks her correspondent (who had concluded that "God is the substance of law"), "do [you] not, in speaking of God, use merely another name for law?"²³ Such was, actually, what the author of *Vestiges* claimed. Sedgwick clearly saw that this kind of natural theology undermined its own premises.

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Sedgwick's writings up to 1850 abound with references to natural religion, but they do not constitute any formal system. They are mere underlying assumptions. In the late 1840s, however, Sedgwick felt the need to be more emphatic about his religious ideas in science and to develop the logic of natural theology. This he did in a new edition of his *Discourse*, which, with its lengthy preface and appendixes,

now swelled out of all common measure: and the *Discourse*, though none of the smallest, is so crushed between a monstrous Preface, and a ponderous, double-headed Appendix, that it begins to look like a grain of wheat between two mill-stones.²⁴

Several reasons might have pushed him in writing a work like this rather than his long-awaited standard work on the Cambrian system, which was actually

²¹ *Life and Letters of Charles Darwin*, i.344.

²² Harriet Martineau had exposed her ideas of social reform in fiction in *Illustrations of Political Economy* (1832-34), *Poor Law and Paupers Illustrated* (1833), and *Illustrations of Taxation* (1834). Her interest in mesmerizing and phrenology resulted in her notorious *Letters on the Laws of Man's Nature and Development* (1851), co-written with Henry Atkinson.

²³ *Nature and Development*, pp.141,164.

²⁴ *Discourse* (1850), p.314.

never published. The Wodehouse argument of “How much good might he do?” might have influenced Sedgwick indirectly in his defense of Christianity. No doubt his decision was spurred on by the continuing popularity of *Vestiges*, of which, notwithstanding his anonymous and crushing critique in the *Edinburgh Review*, edition after edition was published and sold out.²⁵ Moreover, the author of *Vestiges* had appended a sequel to his book in which he answered his hostile reviewers. *Vestiges* was more than ever a threat to religion and to science, and the “ruin and dire confusion” of its creed needed to be countered officially.

It seems strange that Sedgwick’s counter-attack was delayed for so many years, but its publishing history shows that the publication of the new edition of *Discourse*, which was to be out by Easter 1847, was repeatedly interrupted. It had been asked for by the proprietors as early as 1846, during which year the *Discourse* itself was actually reprinted. During the first months of 1847 the Appendix saw its way through the press, and Sedgwick started writing the geological sections of the Preface. Chronic illness and professional engagements then intervened and the Preface was not ready until spring 1849. Before being able to finish the Supplement to the Appendix (containing the notes to the Preface), he met with an accident, which delayed publication further till far into 1850. This fragmentary printing over a period of four years meant that Sedgwick had not seen the work as a whole before publication, and that new discoveries of science during the interval of these four years had to be included as extra notes. Thus, amongst other things, Sedgwick had to change his review of the Nebular Hypothesis, and, more significantly, had to apologize for discussing the sixth edition of *Vestiges* while a seventh revised edition had come out in the meantime.²⁶

The new edition of *Discourse*, in fact, as Sedgwick himself was the first to recognize, was not a formal treatise of natural theology. It is fragmentary and repetitive at times, and lacks a coherent line of thought: its parts were clearly written at different times, and have the appearance of individual essays written on the same subject after long interruptions. His defense of this method is not convincing: “I believe that few persons will read this Preface through, while many may turn over certain sections of it.”²⁷ On the whole, *Discourse* is symptomatic of Sedgwick’s physical inability to put his best ideas down on paper.

Notwithstanding its structural shortcomings, *Discourse* was received as Sedgwick’s *magnum opus* on physical and moral philosophy. Richard Owen

²⁵ Although *Vestiges* was not respected by men of science, “it was new in the popular literature of this country; and more than this, it was systematical and positive, and seemed to offer to the smatterers in natural science a kind of short and royal road to universal knowledge. By such persons it has been received with no common favour” (*Discourse* (1850), p.xx).

²⁶ *Discourse* (1850), p.319.

²⁷ *Discourse* (1850), p.ccxvii.

described it as "the best work on the principles of Revealed and Natural religion extant in our language."²⁸ Darwin admitted that Sedgwick's "is a grand piece of argument against mutability of species."²⁹ Robert Southey and William Wordsworth reacted positively to the part on morals: "It is indeed most gratifying to see you employing your sledge-hammer against Utilitarians; and counteracting the mischief which has been done by Locke and Paley;" "I was [...] most nearly touched by your observations on Paley's Moral Philosophy, which, tho' like all his works a Book of unrivalled merit in certain points, is deplorably wanting in essentials."³⁰ All in all, *Discourse* made Sedgwick one of the leading nineteenth-century thinkers on natural theology.

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The 1850 edition of *Discourse* has become famous as the major geological reaction to *Vestiges*. Sedgwick specifies that he was made to answer its author's illogical assumptions in pursuing his scientific argument. He expressly does not want to attack the author on religious grounds: "[it] is as flagrant an instance of bad logic as is to be found in the whole catalogue of human fallacies [...] No moral accusation is, however, brought against him. He writes in good faith."³¹ The *Discourse* is none the less a religious treatise which does not exclude the author's personal feelings on the subject:

It has been stated by our Author, in language that I cannot read without feelings of loathing and deep aversion (for it is irrational, ignorant, and profane), that God is not a present living providential governor of the world of nature.³²

Discourse, in fact, is a cumulative argument of a theologian marshalling scientific evidence against the claims of the materialistic school of pantheism, in which science is clearly the handmaid of religion. Chambers anticipated in the Explanation of *Vestiges* that a materialistic point of view must perforce result in "a complete revolution in the view which is generally taken of our relation to the Father of our being."³³ In fact there was much more at stake for Sedgwick than mere scientific principles. His very decision to publish his refutation of *Vestiges* in a preface to a reprint of the text of a *sermon* delivered before the University of Cambridge in 1833, rather than as a separate treatise, is telling.

²⁸ *LLS* ii.193.

²⁹ *Life and Letters of Charles Darwin*, i.344.

³⁰ Letter from Robert Southey, February 10, 1834, *LLS* i.427; letter from William Wordsworth, May 14, 1834, *LLS* i.427-8.

³¹ *Discourse* (1850), pp. lxiv, xx.

³² *Discourse* (1850), p.ccxli; cf. also "I can see nothing but ruin and dire confusion in such a creed" (*ibid*, p.clxx).

³³ *Vestiges*, p.277.

Sedgwick's starting point in his defense of monotheism is that the argument of the materialists is incomplete. Although he accepts with the materialist that in nature we observe widely different material actions working together in such a way as to ensure final harmony and order, and that in the changes and movements of nature we perceive laws, which are our second causes, we know from experience that there is a wide difference between things produced by man and the works of second causes. One is the product of design, the other of law. This, on analogy, leads us to the conception of a First Cause, capable of producing the visible world. Materialists, however, emphasize that, although we can define laws, we know nothing about the powers which set them operating. But when they therefore assert that we only have a chain of second causes without indication of a beginning or end and thus strip God of his personality, of his creative and sustaining power, they ignore the facts of inductive science. Sedgwick concludes that "it is now beyond dispute, and is proved by the physical records of the earth, *that all the visible forms of organic life had a beginning in time*. To have established this point is the glory of Geology."³⁴ So, if the geological facts of Chambers's theory can be proved to be unsound, his whole system of pantheism will fall with it.

Geology shows that there is no evidence for progressive development through transmutation. The many breaks in the organic scale and the examples of higher organisms coming into being before lower refutes any theory based on species changing into new species. There are undoubtedly many changes in the organic world through time, but these are explained by the changing physical conditions of the globe, not merely by time. In his Presidential Address of 1831, in responding to Lyell's steady state system, Sedgwick had stressed that

the approach to the present system of things has been gradual, and that there has been a progressive development of organic structure subservient to the purposes of life.³⁵

Here Sedgwick used evidence of progression against Lyell's steady-state system, an opinion he still holds in 1850:

Past Nature has been progressive, as we learn from the records of the earth. We may then believe that she has reached no eternal resting point, but may be progressive still.³⁶

But to base this progression on transmutation is a fortuitous assumption which contradicts the results of inductive science. On this point Sedgwick has not only the allegiance of such eminent directionalists as Cuvier, Agassiz, Owen and Forbes, but also of the uniformitarian Lyell, all of whom he quotes.

³⁴ *Discourse* (1850), p.xvii.

³⁵ Presidential Address (1831), p.306.

³⁶ *Discourse* (1850), p.ccvii.

Vestiges and transmutation were “inadequate and untrue” to the directionalist and uniformitarian alike:

creation has been progressive on the whole—probably because adapted to progressive conditions—yet has this progress (when studied in detail) been so effected as to bid defiance to the pantheistic theory of development.³⁷

Lyell used the word “progressive” in the same ambiguous way in a letter to Poulett Scrope.³⁸ There is no clear distinction between a chronological and a directional meaning of the term—mere change through time and change towards a higher state—although Sedgwick did believe in the reality of

the ascertained historical development of the forms and functions of organic life during successive epochs, which seems to mark a gradual evolution of Creative Power manifested by a gradual ascent towards a higher type of being [...] to meet, we might say, the rising wants of a progressive nature.³⁹

The use of the word “evolution” here is rather ironical in retrospect.

What becomes clear from these examples, and from the earlier discussion of Lyell's use of the word “progression,” is that a poverty of language is partly responsible for the impossibility to take an effectual stand against evolution after 1859. It is, indeed, ironic that elsewhere Sedgwick had remarked of the language of the materialists that they “often find it impossible [...] to describe the phenomena before them, without falling into language implying the reality of those very final causes which they have in theory denied.”⁴⁰ Sedgwick's own insistence on progression certainly did not help to change Darwin's ideas of evolution. A hastily inserted and not very convincing final note before printing the last part of the 1850 *Discourse* proves this point further. He writes that a friend of his had objected to some expressions used in the already printed preface which seemed to “lean towards a theory of development.” Sedgwick admits that this might be so, but that his intention had been altogether different—that he only wanted to express that “Nature had been progressive: and this I urged as an analogical argument in favour of a belief that our future condition might be progressive.” This late apology shows that Sedgwick had not been fully aware of the ambiguity of his language, or, more likely, as this final apologetic statement confirms, that he was not able to avoid the term “progression.”

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Thus far it had been easy for Sedgwick to point out the weaknesses of *Vestiges*

³⁷ *Discourse* (1850), p.274.

³⁸ *LLL* i.270.

³⁹ *Discourse* (1850), pp. cliv, ccxxxi.

⁴⁰ *Discourse* (1850), pp.xiii-xiv.

and the incompetence of its author, but the religious implications of eliminating the division between material and moral of the materialistic school needed a more subtle approach. Sedgwick based this approach entirely on the logic of natural theology. He reiterates that the unity of plan we conceive in nature is the consequence of laws. That these laws all work together so as to “end in beauty and harmony and order, [...] we comprehend under a law of adaptation, or a unity of will in that central Power which ordained all things; and thus we naturally rise to a conception of the unity of the Godhead.”⁴¹ Thus far the argument is not essentially different from Chambers’s. But the author of *Vestiges* fails to recognize, Sedgwick continues, that there are different types of laws: laws to which dead matter answers, the laws which are adapted to the wants of animals, and the moral laws under which man finds himself. The fact that these different laws work together in harmony implies a “great central and sustaining Power of the universe.” Moreover, an innate principle of causality leads us to contemplate a personal designer; it makes us reason from humble facts to general causes, and from these causes we must perforce “ascend higher still—to a conception of personal intelligence and design.”⁴² And only then, looking back on our train of reasoning, can we “rise in thought towards a *right* comprehension of law, and order, and cause; and thus bring all nature into harmony.”⁴³ Without the emphasis on *right* the argument might seem circular. It is, however, an essential step in Sedgwick’s argumentation. He advances his thesis through an example from astronomy. The mechanisms of the material world teach us about the bodies in space we have never visited. Man has senses to perceive the distant spheres and a mind to interpret his perception. This leads him to form an idea of the laws to which the spheres move. This relationship of message-receiver is part of revelation, and it reveals

the ubiquity of the Godhead, and of his never-ceasing power, manifested in the material laws of the natural world and in their *adaptation to the mind of man*.⁴⁴

We have already remarked that Sedgwick asserted that physical and moral truths rest on different foundations. If this distinction is not made, the many complexities raised by the progress of science will lead thinkers to deism, pantheism, materialism or atheism—all systems of thought which reject the veracity of the Scriptures. In the system of the author of *Vestiges* the word of God had disappeared behind an impersonal and self-sufficient set of laws of the creation and its sustenance. But there were similar manifestations in these schools of thinkers which were equally harmful to religion.

⁴¹ *Discourse* (1850), p.cxlili.

⁴² *Discourse* (1850), p.clxxx; elsewhere Sedgwick speaks of “a principle within [man] himself, a part of his very being, whereby he is led to something far above what he knows and learns by his own experience” (*ibid.* p.clxxviii).

⁴³ *Discourse* (1850), p.clxxxix (emphasis mine).

⁴⁴ *Discourse* (1850), p.clxxxvi (emphasis mine).

In 1841 David Friedrich Strauss's *Das Leben Jesu* reached the English reading public through the translation of George Eliot. To Sedgwick it was another manifestation of aprioristic reasoning which distorted the facts of inductive science. Thus he attacks Strauss for an illiberality of spirit:

his boasted freedom is but a servile determination to make all authority however venerable, and all historical arguments however well supported, give way before his master's metaphysical creed, which he accepts without reserve, and makes stand in the place of demonstrated truth.⁴⁵

The next step is evidence of the fallacy in the master's creed. Hegel's *Philosophy of Nature*, Sedgwick argues, is but "one unmixed, unredeemed mass of almost incredible ignorance and blundering."⁴⁶ This is not to assert that Hegel was a man without genius or intellect, but it proves that there is something fundamentally wrong in his method of reasoning. Similarly, Strauss is not denied "great learning and critical skill," but his pantheistic premises make it impossible for him to feel the truth of Christianity.⁴⁷ Here Sedgwick quotes John Stuart Mill: "the spirit of the desired conclusion (the establishment of Hegel's philosophy) pervades the detail as well as the plan of all the earlier parts of the *Life of Jesus*."⁴⁸

One of the great evidences of Christianity is its historical fact, which is fundamental in forming truth: "It is with moral truth as with physical. Our first elements of truth are derived, by experience, from without."⁴⁹ And history tells us of the existence of Christianity as a fact of truth. If not, "we must believe in a systematic conduct out of all analogy with what we know of human nature, and in a series of consequences that mock the whole experience of history."⁵⁰ The Scriptures, although unquestionably written in poetic and figurative language, are as far from myth as possible, as myths are produced long after the event they enhance; myths do not make creeds but embellish them, myths never become popular at once but slowly gain their popularity. The Gospels have from the very beginning been acted upon as historically true.⁵¹

If Sedgwick argues that the Gospels are historically true, this does not take away the apparent contradictions between religion revealed and natural. Their different foundations do not reassure the doubter turned deist. In various instances, in fact, Sedgwick admits that Christianity is not without problems, that there are many things both in nature and in morals which are difficult to explain. In the 1850 edition of *Discourse*, Sedgwick admits his "own difficulties

⁴⁵ *Discourse* (1850), p.cclxv.

⁴⁶ *Discourse* (1850), p.cclxviii.

⁴⁷ This remark shows the injustice of Cole's accusation that Sedgwick was in alliance with German "new Criticism."

⁴⁸ *Discourse* (1850), p.cclxxiii.

⁴⁹ *Discourse* (1850), p.cclxxviii.

⁵⁰ *Discourse* (1850), p.ccxc.

⁵¹ *Discourse* (1850), p.ccc.

[of deism] in early life.” Elsewhere he affirms that “we not merely find in Revelation doctrines hard to be understood, but the whole scheme of our religion is imperfectly comprehended.”⁵²

The discrepancies between the discoveries of geology and Genesis are among the “difficulties”: when preparing his Norwich lectures on geology in 1835 he admits that “geology introduces some tender topics which require delicate handling.” Fifteen years later in *Discourse* he admits that “there are difficulties in the interpretation of the opening words of the Book of Genesis,” and in a letter to Mrs Cropper on geology and revelation he writes in 1858 that there exist “points respecting which I do not profess to see my own way very clearly.”⁵³

If on the one hand there are difficulties in Christianity, on the other Sedgwick shares the faith in progress and truth with many other geologists. The progress of geology helps in establishing the universal harmony of design apparent everywhere in nature. This is important in two ways. First, it is separate evidence for the existence of a personal and active deity; secondly, it helps, through analogy, the believer to accept the difficulties either natural or revealed religion might present. The second point is derived from Butler’s *Analogy of Religion*. Thus what was repressing in Anglicanism to Lyell, was comforting to Sedgwick. Whereas Lyell found the Unitarian approach to the system of the creation “much more comfortable and consolatory,”⁵⁴ Sedgwick finds reassurance in Butler’s system:

the argument drawn from analogy may be of the deepest value. So much I may say from the remembrance of my own difficulties in early life. Thousands, I am certain, have gained both in their moral and intellectual health by the study of Butler.⁵⁵

On the principle of analogy, natural truth finds its mirror image in revealed truth, and vice versa. Thus Scripture tells us of the recent creation of man, which is confirmed by geology. Both prove that the order of nature is not eternal. Another important analogy establishes our faith in a future existence:

our Religion tells us that the moral scheme, of which we form a part, is progressive, and does not end here. Nature seems to tell us the same truth.⁵⁶

Both nature and revelation tell us of God’s omnipotence and omnipresence.

However, both nature and revelation do raise difficulties. Although this might at first sight only be perplexing for the believer, it is actually only what might be expected. In religion, as in science, “we know but in part” because

⁵² *Discourse* (1850), pp.cccxxi, cccxix.

⁵³ Letter to Wodehouse, *LLS* i.452; *Discourse* (1850), p.cccvi; June 5, 1858, *LLS* ii.344.

⁵⁴ To George Ticknor, March 11, 1859, *LLL* ii.322.

⁵⁵ *Discourse* (1850), p.cccxxi.

⁵⁶ *Discourse* (1850), p.cccvii.

our studies are limited “by the narrow conditions of our being.” Man is part of a scheme where

the religion of Christ was only matured after many centuries of preparation, was slowly received among men, and is now but partial in its visible benefits [... and where] discoveries, however, important to the race of man, long remain concealed, spring up gradually, and after they are published are neither universally known or accepted.⁵⁷

Both religion and science are subject to slow progress, which will gradually clear up our perplexities. Thus Sedgwick's and Lyell's ideas of progress are of the same optimistic stamp so characteristic of the first half of the nineteenth century.

⁵⁷ *Discourse* (1850), pp. cccxii-cccxiii.

CHAPTER TEN

WILLIAM WHEWELL: LYELL'S LABOURS AND IDEAS

Although Lyell and Sedgwick are usually seen as champions of antagonistic theories of geology, they actually share more in their scientific outlooks than is often supposed. Their religious suppositions are very much the same and, as honest scientists and believers, both join in a battle to "free the science from Moses." Even their respective defences of uniformity and catastrophism seem at times to merge so much as hardly to merit the name of controversy. Such seems to be the conclusion of the philosopher of science William Whewell.

Lyell's research was a major influence on Whewell's geological thinking. He reviewed the first and the second volume of *Principles*, and, although not disposed to accept the theory of uniformity, he discusses Lyell as no other scientist in the long sections on geology in both the *History of the Inductive Sciences* (1837) and its sequel the *Philosophy of the Inductive Sciences* (1840).

William Whewell, son of a Lancashire carpenter, born in 1794, was Lyell's senior by only three years. He was not an original contributor to the science of geology, but his extensive knowledge of the physical sciences included geology. Much practical geology he no doubt picked up during the many field tours with Sedgwick.¹

Whewell's entrance in 1811 at Trinity College, Cambridge, as a sizar, was followed by a long and successful career there, which culminated in his nomination to the influential post of Master of Trinity after Christopher Wordsworth's resignation in 1842. As a fellow of Trinity he had to take clerical orders, but he showed none of the reluctance to theological studies that Sedgwick felt, and his learning in this field led to the prestigious appointment of Professor of Moral Philosophy in 1838.

More interesting for our present purpose is that Whewell filled the post of Professor of Mineralogy, which he kept for four years from 1828. In the preceding year he had been elected a fellow of the Geological Society of London, and, when Lyell resigned the presidential chair in 1836, Lyell and Murchison, later seconded by Sedgwick,² asked Whewell to fill the chair for the next two years. Although Whewell accepted in the end, he had reservations about his suitability for the post. To James David Forbes (1809-1868), Professor of Natural Philosophy at Edinburgh, he writes about the Geological

¹ For Whewell's knowledge of geology, see also Ruse, "William Whewell: Omniscientist," pp.106-110.

² See letter to Sedgwick, October 6, 1836 in *LLW* ii.245-47; see also *LLW*, i.97.

Society's decision to make him its president "which I fear you will think no great argument of their wisdom."³ It is true that the Geological Society was hard pressed for a candidate, but the choice was not a bad one. The President of the Society had to deliver an anniversary address in which he briefly discussed the progress of the science during the past year. Whewell was the originator of the valuable Reports of the British Association for the Advancement of Science, founded in 1831. He urged W. Vernon Harcourt at its foundation to model the Reports on the Presidential Speeches of the Geological Society.⁴ Moreover, as author of a work on the history of geology, which Lyell knew Whewell was preparing, he seemed the right candidate. Whewell's knowledge of the progress of science was much respected among professional geologists.

Whewell's wide interest in the natural sciences led to his two philosophical treatises on the inductive sciences, and, not insignificantly in the present context, he is responsible for one of the eight Bridgewater Treatises: *Astronomy and General Physics, Considered with Reference to Natural Theology* (1833). Whereas Lyell accepted elements of natural theology as an unquestionable afterthought in his scientific investigations, and Sedgwick believed that natural theology was the active principle behind his science which confirmed the belief of the believer, Whewell was a systematic thinker of natural theology who applied it to geology in that truly philosophical spirit which is generally missing in Lyell and Sedgwick.⁵

Whewell thought highly of Lyell's *Principles* but firmly contested the latter's notions of uniformity. He reviewed the first volume for *The British Critic*. This review led Lyell, who had thanked Whewell "for the great service you have done all geologists, and me in particular, by your splendid article,"⁶ to recommend him to John Gibson Lockhart, then editor of the *Quarterly Review*, for a review of the second volume. Lyell urged Whewell that

I am, moreover, interested for my own sake in the job's not falling into the hands of some journeyman performer, whose clumsy puff (to please the publisher) will be much less creditable to me than the overhauling which I am prepared to expect from you.⁷

The second volume of *Principles* impressed Whewell even more than the first and he agreed to write the review for the *Quarterly*.⁸

Whewell's attitude to Lyell's work is ambiguous. There is a strange mixture of admiration for his methods and sharp criticism of his principles

³ February 20, 1837, *LLW* ii.252.

⁴ Letter to Harcourt, September 1, 1831, *LLW* ii.127.

⁵ For a discussion of Whewell's evaluation of natural theology as a religious principle, see Brooke, "Indications of a Creator: Whewell as Apologist and Priest."

⁶ *LLW* ii.108-9.

⁷ Lyell to Whewell, November 10, 1831, Wilson, *Charles Lyell*, p.327.

⁸ The first volume was reviewed in the *British Critic* in 1831 (henceforward Review 1831), the second in the *Quarterly Review* in 1832 (henceforward Review 1832).

which in time increased in asperity. At the same time, in his writings on the progress of geology Whewell relied much on knowledge which, he admits in a letter to Lyell, “is derived from persons like yourself.”⁹ Although he was aware that Lyell was making a case for a geological principle and might be expected to use evidence in favour of his theory, one cannot but suspect that Whewell often relies too much on the objectivity of *Principles*. He often criticized Lyell’s assumptions in geology while using the geologist’s own examples. His religious presuppositions, moreover, conditioned his geological outlook and impeded a more impartial view of uniformity.

The philosophy of geology

In the *History of the Inductive Sciences* Whewell writes that the causes which have produced geological phenomena

have been as similar to existing causes, and as dissimilar, as the effects teach us. We are to avoid all bias in favour of powers deviating in kind and degree from those which act at present.¹⁰

The passage seems contradictory: initially it establishes the possibility of catastrophes which in the second statement are shorn of any aprioristic probability. Much of Whewell’s philosophical evaluation of uniformity in nature concerns the formation of geological theory and the fallacy of allowing a bias to one theory rather than another. Science should not be conducted by *a priori* probabilities but on a firm inductive basis which in time might lead to theory.

Whewell means by “theory” a last step in the cultivation of a science like geology. In the *History* and the *Philosophy of the Inductive Sciences*, Whewell describes geology as a palaetiological science, “in which the object is to ascend from the present state of things to a more ancient condition, from which the present is derived by intelligible causes.”¹¹ As examples of this class he mentions geology, glossology and comparative archaeology. On analogy with Whewell’s favourite science astronomy, palaetiological sciences can be divided into three branches: phenomenology, aetiology and theory. The first division regards the description of facts and phenomena, the second the analysis of causes, the third introduces the principles of intelligible connection “which are identical with the total system of the *Facts*.”¹² In geology Whewell mentions as the founders of the first branch Werner, Cuvier and Smith; Lyell gets the

⁹ January 31, 1831, *LLW* ii.109.

¹⁰ *History* iii.615.

¹¹ *Philosophy* i.637. See Hodge, “History of the Earth, Life, and Man: Whewell and Palaetiological Science” for the place Whewell gave geology among the inductive sciences.

¹² *Philosophy* i.664.

honours of the second branch. The two antagonist doctrines—catastrophism and uniformitarianism¹³—are premature efforts at theory. The inductive basis in geology has still to be worked on, a judgment often echoed in the remarks by Lyell, Sedgwick and Buckland that geology is still in its infancy. Actually, no sound theory is yet extant in any of the palaeiological sciences.¹⁴ Whewell showed in his writings an almost fanatical distrust of deductive reasoning in science.

Whewell accused Lyell's uniformity of aprioristic reasoning. Lyell himself does not deny this tendency in his work, but adds that a bias to uniformity is more philosophical than a bias to catastrophical theory. To Whewell, however, if a bias should be allowed, religion itself might claim it. A beginning of things presents itself logically to our minds, and the palaeiological sciences make it their business to imply an *a priori* acceptance of a beginning of things.

*

Sedgwick saw the tendency to form theory as the capital sin of the geologist because it endangered the progress of the science and its fair inductive basis. Whewell shared Sedgwick's caution and in his review for the *British Critic* of the first volume of *Principles* he starts with a short eulogy of the spirit of the modern geologist:

Notwithstanding that the labour and industry of our geological observers have been such as men seldom bestow, [...] their self-denial and temperance in abstaining from theory-making have been quite as eminent as their diligence in collecting materials.¹⁵

Whewell asserts with humour that among the geologists there was "a strong suspicion of all generalities," which rule of thumb seemed so well established that whenever a book on systematic geology appeared, "it was immediately certain that it did not proceed from the pen of any good working geologist."¹⁶

Such a prelude did not seem to bode anything good for Lyell's book, which put all its force in reasoning from facts to theory. But Whewell, unlike Sedgwick, thought that enough material had been accumulated to justify some tentative theorizing and, with the insight of the historian, saw a welcome "augury that the spell was broken," that Lyell's *Principles* would be followed by fruitful speculative controversy. To ascend from inductive to deductive science is a requisite trial to make geologists "discuss any plausible mode of

¹³ Whewell actually coined these words in Review (1832), p. 126.

¹⁴ *Philosophy* i.664.

¹⁵ Review (1831), p. 182.

¹⁶ Review (1831), pp. 183, 184.

deducing inferences from their phenomena.”¹⁷ *Principles* was therefore hailed by Whewell on grounds which made Sedgwick suspicious of it.

Whewell’s praise of Lyell’s book did not include the latter’s notions of uniformity, but the review, written for a general reading public, criticizes it with well-humoured irony, as for example in the discussion of Lyell’s dismissal of catastrophist machinery:

Mr. Lyell throws away all such crutches; he walks alone in the path of his speculations; he requires no paroxysms, no extraordinary periods; he is content to take burning mountains as he finds them [...] He requires time, no doubt: he must not be hurried in his proceedings. But if we will allow him a free stage in the wide circuit of eternity, he will ask no other favour; he will fight his undaunted way through formations, transition and flötz.¹⁸

The discussion then takes a more serious turn, and the reader feels that Whewell has a point to make. It comes towards the end with the rather unfair conclusion that Lyell’s uniformitarianism “must speedily fall back into the abyss of past fantasies and guesses from which he has invoked it in vain.”¹⁹ Earlier on in the review, however, he had written that nothing could be more unjust than the impression that *Principles* is “a tissue of fanciful speculations and hazardous conclusions.”²⁰ The hostility of this finale, shrilly out of tune with the liberal welcome of the opening pages, is to be regretted and obscures the respect in which Whewell held Lyell’s book. He must have been aware of this as he later apologizes to Lyell, saying in a letter that

I was afraid after I had finished, that in my speculations upon the trains of thought which your book had raised, I might have omitted to express the great respect I felt for the work and the strong pleasure with which I had read and reread it.²¹

All the same, Whewell, as a philosopher and historian of science, was not to welcome attempts at theory again. In 1837 he ends the chapter on uniformitarianism in the *History of the Inductive Sciences* with a final consideration on the progress of geology by stressing that it is not time yet to embark on physical geology (ie. theoretical geology), “as the most promising means of promoting this science, is the strenuous cultivation of the two subordinate sciences, geological knowledge of facts, and geological dynamics.”²² And again in 1840 in the *Philosophy*, he emphasizes that most of the palaeiological sciences

are very far from having completed and systematized their Phenomenology: in

¹⁷ Review (1831), p.184.

¹⁸ Review (1831), pp.185-6.

¹⁹ Review (1831), p.204.

²⁰ Review (1831), p.186.

²¹ January 31, 1831, *LLW* ii.109.

²² *History* iii.621.

all, the cultivation of Aetiology is but just begun, or is not begun; in all, the Theory must reward the exertions of future, probably of distant, generations.²³

The hopeful expressions of the 1831 reviewer of a new horizon in geology have made place again for the traditional warning that the time for the Newton of geology has not yet come. In 1837 he peevishly resorts to the purpose the Geological Society set itself at its foundation in 1807:

Here, then, is the point where the labours of geologists may be usefully applied; and not in premature attempts to decide the widest and abstrusest questions.²⁴

In the evolution of Whewell's thought during the 1830s and 1840s, we see a tendency to deride speculative theory in palaeontological science which might well be indicative of his fear for religion if uniformity were accepted.²⁵

Whewell, although strictly speaking not a geologist, must have been a formidable antagonist for Lyell. Whewell's opinion carried weight as Lyell admitted in a letter to his sister that "[he] has more influence [in Cambridge] than any individual, unless it be Sedgwick."²⁶

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In later attacks on uniformitarianism Whewell developed his tactics to defeat Lyell's argument on its own grounds. Already in the 1831 Review Whewell had turned the tables on Lyell by using the latter's own criticism of former geologists:

If men may go wrong, as Mr. Lyell asserts of former theorists, through a disposition "to assume that the economy of nature was formerly governed by rules different from those now established," is it not possible also to err by holding that the economy of nature must have been the same at every period of the earth's existence [...] If, to assume à priori any *given* succession of paroxysms and crises would be inexcusable and absurd, how is it less so to assume a law equally arbitrary, the negation of all such variations in the intensity of the unknown forces?²⁷

Whewell wrote the passage above when he had only seen the first volume of *Principles*. When the third volume appeared, and, in a chapter entitled "Methods of Theorizing in Geology," Lyell pointed out the true tenet of the first two volumes, Whewell seized upon the statement that the geologist should try

²³ *Philosophy* i.665.

²⁴ *History* iii.621; ironically, Whewell's source here is Lyell's *Principles* i.71-2.

²⁵ Todhunter senses an inconsistency in Whewell's "notion that induction involves something which elevates and ennobles, while deduction is grovelling and servile," especially as his supreme science, astronomy, "is almost independent of that induction to which he attaches a preeminent value. The triumphs of Astronomy are essentially triumphs of deduction" (*LLW* i.107).

²⁶ Letter to his sister Marianne, November 14, 1830, *LLL* i.312..

²⁷ Review (1831), pp.202-3.

with “an earnest and patient endeavour to reconcile the indications of former change with the evidence of gradual mutations now in progress.”²⁸ In the *History* Whewell italicized the “earnest and patient endeavour to reconcile” and thought it a rather dubious principle in science, “[not] the temper in which science ought to be pursued.” In the *Philosophy* he quotes Lyell’s statement again and adds: “if by *known* causes we mean causes acting with the same intensity which they have had during historical times, the restriction is altogether arbitrary and groundless.”²⁹

To Whewell uniformity is an acceptable principle as long as present causes adequately explain the effects of past ones, but if the effects are different from anything we can witness today, then it is necessary on philosophical grounds to start considering unknown causes as “the effects must themselves teach us the nature and intensity of the causes which have operated.”³⁰ And past effects did seem to require forces different from known ones. Dogmatic uniformitarianism, to Whewell, endangered the progress of science as it would obstruct the discovery of new causes. Its principle is short-sighted and not very different from the attitude of the geologists of the past whom Lyell criticized.

This does not mean that Whewell discarded the methodological principle of investigating the past by studying the present. In reviewing Lyell’s second volume of *Principles* in 1832 he writes that

upon the most pregnant evidence geologists have arrived at the conviction that we can hope to understand the past operations which have formed the strata of the globe, and brought together their contents, only by making ourselves acquainted with the operations which are still in progress on the surface of the earth,—by studying the whole range of organic life, the relations of its classes, and the laws of its mutations.³¹

But Whewell, like most geologists, distinguishes between a methodological principle and a philosophical principle. Thus he can write two pages later that

we should not be so sanguine as to look to known causes for an explanation of such appearances, or to define the mode in which the unknown have acted.

The scientist can but start from the known in explaining the unknown; this, however, does not mean that the geologist should force a principle of actualism, let alone uniformity, upon the system of nature and conclude that, because the only way he can proceed is from the known to the unknown, past causes are the same as present ones. In other words, Whewell, to whom in fact the greater part of the big revolutions of nature seemed to require causes different from the present ones, set a limit to the principle of uniformity. The

²⁸ *Principles* iii.3.

²⁹ *History* iii.616; *Philosophy* i.668.

³⁰ *History* iii.616.

³¹ Review (1832), p.104.

elevations still taking place are limited, local, and unconnected, and as of all forces known we cannot 'select' and 'combine' so as to cause the immense elevations we find proof of in the past, Lyell's assumption of uniformity is "but to introduce into our system a perfectly arbitrary condition, which deprives it of all claim to be looked upon as a legitimate and inductive connection of the two sets of appearances [past and present]."³²

Lyell calls upon unlimited time—and Whewell cannot but admit that the geologist should not be parsimonious with time³³—but "Mr. Lyell seems to thirst for an antiquity of this earth even greater than that which is indicated by geological phenomena themselves."³⁴ It is not philosophical to apply the influence of time to limit force: "to call in the one to protect us from the other, is equally presumptuous."³⁵ The period we live in should not arbitrarily be called in as "the standard for all other epochs."

Although Whewell never excluded new causes, the core of his attack on uniformity picks on the element of force. In his discussions from the 1831 Review to the *History* in 1837, he had clearly distinguished uniformity of kind and of intensity. By 1840, in the *Philosophy*, this had become only uniformity of intensity. It shows that Whewell thought the debate between uniformity and catastrophism centred around questions of intensity and that actually there existed only a difference of opinion as to degree in the two doctrines. This he had already hinted at in the 1832 Review, and it is developed in his discussion of the cyclical nature of uniformity.

Lyell had contended that, although phenomena of disturbance are local and of short duration, "they are nevertheless universal, if we extend our views to a sufficient lapse of ages."³⁶ To Whewell this meant that uniformity could only exist in a very large cyclical sense. Cycles of violent upheaval and repose may be repeated so often as to constitute infinite uniformity when seen together. This much Whewell was willing to concede, but then the difference between uniformity and catastrophism fades. Whewell objects that we cannot estimate the length of such a cycle, and, put to the extreme, why should we admit that our experience is based upon more than one cycle? If we are part of one cycle, we cannot exclude that the great convulsive powers have acted at the beginning at a maximum and have since tended towards a minimum. Thus uniformity does by no means exclude catastrophes. For man there is no knowing where to draw the line between one cycle and another, and without cycles we cannot speak of uniformity:

³² Review (1831), p.200.

³³ In the 1832 Review he writes that "we have no occasion to embarrass ourselves for want of thousands, or, if it be necessary, of millions of years," p.108.

³⁴ Review (1831), p.202.

³⁵ *History* iii.616.

³⁶ *Principles* i.257.

thus violence and repose may alternate upon a scale of time and intensity so large, that man's experience supplies no evidence enabling him to estimate the amount. The course of things is *uniform*, to an Intelligence which can embrace the succession of several cycles, but it is *catastrophic* to the contemplation of man, whose survey can grasp a part only of one cycle.³⁷

Whewell's insistence on cyclical recurrence in his analysis of uniformitarianism is rather misleading. Lyell never insisted on cyclical regularity in geology, but merely proposed that change is constant through time, that present causes suffice to explain past change. Lyell, in a letter to Whewell early in 1837, following a conversation "touching the extent to which I carried my doctrine of 'Uniformity'," emphasized that

it was impossible, I think, for anyone to read my work, and not to perceive that my notion of uniformity in the existing causes of change always implied that they must for ever produce an endless variety of effects, both in the animate and inanimate world. I expressly contrasted my system with that of 'recurring cycles of similar events'... I never drew a parallel between a geological and an astronomical series or cycle of occurrences.³⁸

The letter came too late for modifications in the *History*,³⁹ but even in later editions and in the *Philosophy* Whewell stuck to his interpretation of uniformity as cyclical.

Both Lyell and Whewell believed in the reality of *verae causae* in science, but, as Michael Ruse has pointed out, Whewell's idea of a *vera causa* was fundamentally different from Lyell's.⁴⁰ Whereas to Lyell it meant applying known causes to past phenomena, *verae causae* to Whewell are but those basic principles which are seen underlying different areas of science, especially those which are shared by similar sciences, in this case the palaetiological sciences. This difference has far-reaching implications for uniformitarianism. The analogy with other sciences does not work in the favour of uniformitarianism. The analogy with astronomy is a false one: as a study of cyclical motions it has nothing in common with geology; as a palaetiological science it points to a beginning, and is thus not analogous with uniformitarianism. All palaetiological sciences deny the possibility of cycles; for example, we do not find anywhere a language in the process of formation.

³⁷ *Philosophy* i.671.

³⁸ Letter to Whewell, March 7, 1837 (*LLL* ii.3).

³⁹ It is difficult to date the *History* with exactness, but, although the objections Lyell answers here are those which appeared in print in the *History*, we can safely exclude Lyell's knowledge of it. First, he refers to a conversation and not to the book. Secondly, Whewell had written on February 20th to J.D. Forbes that he expected his book "out in less than a month," but the book could hardly have been published before March 7th, as a week later, on February 26th, he was still busy "with a history of science from the earliest to the present times, which has given me a great deal of trouble, or at least of work, and is likely to do so still" (letter to Northampton, *LLW* ii.254). The book was out by May 13th (letter to Richard Jones, *LLW* ii.254).

⁴⁰ "Charles Lyell and the Philosophers of Science," pp. 121-131.

Lyell's steady-state system did not fit Whewell's notions of palaeiological science. In these sciences we consider the events "as forming a chain which is extended from the beginning of things down to the present time;" and the causes connect the successive links of this chain, "they form a kind of progression which we may represent to ourselves as having acted *in succession* in the hypothetical history of the earth and its inhabitants."⁴¹ The signs of a beginning in palaeiological science annihilates the concept of cycles:

Is it not clear, in all these cases, that history does not exhibit a series of cycles, the aggregate of which may be represented as a uniform state, without indication of origin or termination.⁴²

Thus what we see in Whewell as the main obstacle to uniformity is the reality of a beginning, which is a reality in all the palaeiological sciences, otherwise they cease to be such. And the force of the division in palaeiological sciences is that

any sound views which we should be able to obtain respecting the nature of Truth in the physical sciences, and the mode of discovering it, must also tend to throw light upon the nature and prospects of knowledge of all other kinds.⁴³

The progress of science in general depends much on the proper place of a science in its class to establish the "principles, maxims, and rules of procedure [they have] in common."⁴⁴ One principle the palaeiological sciences share is evidence of a beginning.

*

A curious aspect of the discussion of the "two antagonist doctrines" in the *History* is that Whewell proceeds from the point of view in which uniformitarianism invalidates catastrophism and then shows that these grounds are not philosophically sound. The bearing of catastrophist opinions, he writes, upon the progress of physical geology will be better understood by exploring the implications of uniformity. But once having excluded the validity of uniformitarian theory, does this not imply acceptance of catastrophism? It is true that Whewell warns against a bias towards catastrophes, but he never analyzes the difficulties inherent in that theory.

In the *Philosophy* he goes one step further, revealing himself a more outspoken directionalist. He now attacks the theory of uniformity because its arguments are supposed to be only negative, while those of catastrophism are affirmative; the former is exclusively destructive, the latter creative. Uniformity

⁴¹ *Philosophy* i.654,656.

⁴² *History* iii.620.

⁴³ *Philosophy* i.641.

⁴⁴ *Philosophy* i.640.

becomes a mere antagonistic principle to catastrophism, while its negations never become affirmations without invalidating uniformitarianism itself. It is to be regretted that Whewell added this section to his discussion of uniformity, as it shows an all too eager bias to the opposite theory. Moreover, the reasoning does not carry conviction and the approach suffers from the same negative argument for which he blames the uniformitarian. Whewell denies the uniformitarian his own system of principles when he maintains that catastrophism

is constantly bringing fresh evidence of some great past event, or series of events, of a striking and definite kind; his antagonist is at every step explaining away the evidence, and showing that it proves nothing.⁴⁵

To prove this point he gives four examples: (1) the uniformitarian denies the catastrophist's proof of a universal deluge, (2) gradation of strata in one place explains the catastrophist's convulsive breaking up of the same strata in another place, (3) time alone will do for extensive and lofty elevations, and (3) he doubts that the increase of temperature as we descend to the centre of the earth indicates an original incandescent state.

In the first three examples Lyell had made a good case for uniformity. In the last example he had only used caution—"let us not hastily assume that it has reference to the original formations of the planet"⁴⁶—but Whewell saw it as the uniformitarian tendency to "escape from the cogency of the reasonings which send us towards an original state of things different from the present."⁴⁷ The uniformitarian, he claims, embraces the nebular hypothesis to "obliterate all special acts of creation" but is not willing to adopt it as an affirmative dogma because the hypothesis would also imply direction in the cooling effect of chemical reactions which cannot continue forever: "when the Negations become Affirmations, the Negation of an Origin vanishes also."⁴⁸

It is needless to say that it is unfair of Whewell to deduce the nature of all uniformitarian reasoning from this example, ignoring that it had as its basis a comprehensive system of logic, and to reduce all uniformity to a mere critique of catastrophism. It does show, however, that the antagonistic element of *Principles*, which is no doubt present, did not escape the contemporary reader. The more surprising it is, therefore, that in many parts of his discussion of geology Whewell depended almost blindly on Lyell's authority.

⁴⁵ *Philosophy* i.671-2.

⁴⁶ *Principles* i.143.

⁴⁷ *Philosophy* i.673.

⁴⁸ *Philosophy* i.674.

The history of geology

Whewell might well have thought that he had overturned Lyell's philosophical grounds of reasoning in geology, but the influence of the latter's history, acknowledged and not acknowledged, permeates Whewell's views of the history of geology in a way that makes us question the author's critical methods. Although much has been written about Whewell's reaction to uniformitarianism, his compiling methods in the *History of the Inductive Sciences* are left virtually undiscussed. The issue is not an unimportant one as Whewell's work purports to trace the *history* of science.

In coining the word *palaetiology* to describe those sciences which "ascend from the present state of things to a more ancient condition,"⁴⁹ Whewell compares geology to the work of the antiquary, a proposition with which Lyell had opened his *Principles*. Whewell here goes one step beyond Lyell in claiming that the two sciences are not only similar but also that at times one contributes to the other. Archaeological evidence, for example, can help in geological investigation. Such is the case of "the changes which have taken place in the temple of Jupiter Serapias, near Puzzuoli [*sic*]."⁵⁰ The example is deliberate as on the preceding page Whewell had already referred to the ruined temple with its "sea-worn columns." This repeated reference to Pozzuoli in the very introduction to the palaetiological sciences indeed shows the imaginative power of the example, but Whewell's choice seems a bit careless. Is it possible that he was not aware of the emblematic value Lyell gave it when he used an engraving of it as the frontispiece of the first volume of *Principles* to illustrate the principle of uniformity?

Lyell's *History* seemed authoritative and Whewell fell under its spell. No comprehensive history of geology had been attempted so far, and much information—on the Italian geologists, for example—was new to the English reader. This might have obscured its strategic function.

In 1831 Whewell gave William Vernon Harcourt the names of four distinguished geologists for a BAAS-report on the present state of the science, and added: "I conceive that any man of science applied to compile such a report, would feel himself distinguished by the selection, and would feel also the obligation of research and *impartiality* which such an office would involve."⁵¹ The four names are Sedgwick, Conybeare, Buckland and Lyell. This means that Whewell did not doubt Lyell's honesty as a historian and missed the full force of the strategic function in the first chapters of *Principles* and its consequent distorted views of history. Although Harcourt gave the

⁴⁹ *History* iii.481.

⁵⁰ *History* iii.482.

⁵¹ Letter to Harcourt September 1, 1831; *LLW* ii.127 (emphasis mine).

honour to Conybeare, Whewell based his views of the history of geology in the *History of the Inductive Sciences* on Lyell's. That he took the objectivity of Lyell's history for granted seems beyond doubt. In 1837 he excluded mention of Mary Somerville, author of *Mechanism of the Heavens*, in the *History*. The exclusion was criticized by David Brewster, who "cantankerously" reviewed Whewell's book in the *Edinburgh Review* for October 1837. Whewell defended himself in a letter to a friend: he was "not to compliment away the character of impartiality which alone can give value to a history."⁵² The use of Lyell's history, then, indicates absolute trust in its objectivity. This comes out too in a comparison of Lyell's and Whewell's histories of geology.

As a piece of writing Whewell's history is by no means as impressive as Lyell's. It is true that Whewell's history is selective and only serves to demonstrate his views on the progress and principles of geology, and, to be fair, he admits that the history of geology had already been amply treated by Lyell, Fitton and Conybeare,⁵³ but, although the influence of Fitton and Conybeare is marginal, his debt to Lyell ranges from geologists as wide apart as Fracastoro, Werner, Rouelle, Arduino, Odoardi, Desmarest, Hutton, Gesner, Raspe, and Brander. Although he does not limit himself to the names in geology which Lyell discussed, and adds some which Lyell strangely enough left out, including Da Vinci and Cuvier, his blind rewriting of Lyell's history at other points shows a lack of critical spirit.

Whewell's indebtedness to Lyell in the cases of Fracastoro and Werner is conspicuous as they are the two central figures in Lyell's attack on Mosaic and Neptunist geology respectively. In both cases, Whewell's text is directly derived from Lyell's, and one cannot suppress the idea that Whewell had *Principles* in front of him when he was writing these pages. Of Fracastoro he says that he

wrote concerning the petrifications which were brought to light in the mountains of Verona, when, in 1517, they were excavated for the purpose of repairing the city.⁵⁴

Compare Lyell in *Principles*:

the excavations made in 1517, for repairing the city of Verona, brought to light a multitude of curious petrifications.⁵⁵

To Lyell the instance served to expose how Fracastoro's "clear and philosophical views" were doomed by the unprofitable speculations about the flood, which, Lyell emphasizes, is comparable to the bitterness of controversy in his own

⁵² Undated letter to Richard Jones October 1837; *LLW* ii.260.

⁵³ Fitton in "Annals of Philosophy, N.S. vol. i-ii (1832-3); and Conybeare in "Reports of the British Association," (1832).

⁵⁴ *History* iii.494.

⁵⁵ *Principles* i.23.

time. Whewell's absence of comment of this kind shows that he did not espouse Lyell's view here.

In the case of Werner, however, Whewell abandons all caution and, apart from verbal similarities, also reproduces Lyell's feelings on the obstacles in the progress of geology. The verbal similarities here are striking indeed as they are clearly loaded with prejudice. Whewell speaks of the master's "charm," the very word Lyell uses; he objects that Werner's observations were "made in a very limited district," while in *Principles* we read of the geognosist's "limited district."⁵⁶ But what is most striking here is the literal use of the Lyellian verdict that Werner caused a "retrograde movement" in geology. Whewell's final appraisal of Werner's contribution to geology is that it "cannot be considered otherwise than a retrograde step in science."⁵⁷

Alexander M. Ospovat has argued that Lyell's systematic misrepresentation of Werner triggered a distortion of his role in the history of geology which has lasted till far into our century.⁵⁸ What is interesting here is that Whewell, who as a professor of mineralogy was well-acquainted with Werner's merits, reproduced Lyell's partial judgment of the German professor, the more so when we discover that Whewell visited Freiberg, where Werner's School of Mines was established, in order to study mineralogy.⁵⁹ He often referred, moreover, to the indispensable work of the mineralogists and in the *Philosophy* he "pointed out Werner, William Smith and Cuvier, as the three great authors of Systematic Geology [...] After a beginning had thus been made in giving a genuine scientific form to phenomenal geology, other steps followed in rapid succession."⁶⁰ To clarify Whewell's true opinion of Werner, the following quotation from the 1831 Review is revealing:

To this celebrated school we must not refuse the praise of having undertaken the stratigraphical examination of Europe in a spirit and zeal, of acuteness, and of combination, worthy of the philosophical character of the Germans, and of the vivid and comprehensive mind of the founder of the sect. And even yet we do not possess, for the classification of primary rocks, those namely which are not characterized by remains of organized beings, any better means or rules than have proceeded from the Wernerian investigators [...] It is on this account that we attribute to the Wernerians, as their really valuable distinction, the cultivation of mineralogical or primary geology.⁶¹

It seems that in the *History* Whewell rashly copied Lyell's "retrograde movement" along with the other pieces he borrowed. Unfortunately, in his

⁵⁶ *History* iii.504; *Principles* i.57.

⁵⁷ *History* iii.506; *Principles* i.59.

⁵⁸ See Alexander M. Ospovat, "The Distortion of Werner in Lyell's *Principles of Geology*."

⁵⁹ Letter to Richard Jones, June 25, 1825; *LLW* ii.56.

⁶⁰ *Philosophy* i.646.

⁶¹ Review 1831, p.187.

discussion of Werner's merits he nowhere acknowledges his indebtedness to *Principles*.

The purpose of Lyell's treatment of Werner was the contrast it furnished to Hutton. In describing Hutton in the *History*, Whewell again borrowed from Lyell, but did not add anything in favour of or against Hutton. This is all he writes of the Scottish geologist:

Hutton, the author of the theory of igneous causation which was in this country opposed to that of Werner, sought and found this phenomenon in the Grampian hills, in 1785.⁶²

Like so many subsequent historians, it never occurred to Whewell to compare Werner's "limited district" to Hutton's "Grampian hills." This is exactly what Ospovat objects to in Lyell's condemnation of Werner's "limited district." Ospovat sees it as irrelevant that Hutton's conclusions have since proved true because it was not known in those days that the British Isles exhibit almost all the phenomena of geology. Although the fact that objections are made to Werner's circumscribed area while Hutton's is never questioned is indeed a doubtful critical principle, the latter part of Ospovat's statement is not correct. In Lyell's days there was already a widespread belief that England displayed such a wide range of different strata that it could be taken as an example for the whole world. William Buckland wrote in 1819 that "England is considered as classic ground by the best Geologists of the Continent," and Whewell in 1831 maintained that "our island exhibits, in a form singularly condensed, and yet distinct, most of the members of the secondary stratigraphical series of Europe."⁶³

Antagonistic use of history had no meaning for Whewell. Where Lyell seems to want to convince the reader of bitter controversy, he minimized the discrepancy between the catastrophist and uniformitarian. To Whewell such conflicts between serious geologists belong to the past:

the philosophical eloquence with which they have conducted their discussions has had a most beneficial influence on the tone of their speculations; and their researches in the field, which have carried them into every country and every class of society, have given them that prompt and liberal spirit [...] The time for such general systems, and for the fierce wars to which the opposition of such generalities gives rise, is probably now past forever.⁶⁴

Whewell sees Lyell as one of the greatest contributors to the science of geology. As Werner, Smith and Cuvier are the founders of systematic Descriptive Geology to him, so Lyell is the founder of Geological Dynamics,

⁶² *History* ii.506; the passage is followed by Playfair's description of the joy Hutton felt at this discovery, taken by Whewell from *Principles* i.62.

⁶³ *Vindiciae Geologicae*, p.4; Review (1831), p.188.

⁶⁴ *History* iii.524,605.

the auxiliary science which treats of the aqueous and igneous causes of change as well as of the change in the organic world. Of the aqueous causes Lyell "disclosed the full effects"; "Mr. Lyell's work was important in this [igneous causes] as in other portions of this subject;" for the change of climate Lyell has offered a theory "the ingenuity and plausibility of [... which] cannot be doubted;" the imbedding of fossils "Mr. Lyell has treated [...] in a very full and satisfactory manner;" and Lyell's analysis of change in the organic world is introduced with the following eulogy:

Mr. Lyell, in his work on Geology, has treated these subjects in a very able manner, and in the same point of view in which I am thus led to consider them. I will only briefly refer to some points, availing myself of his labours and his ideas.⁶⁵

To what extent Whewell avails himself of Lyell's labours becomes clear in his refutation of the theory of the transmutation of species. Whewell carefully takes up Lyell's conclusions at the end of his discussion of Lamarckian transmutation: of the six points Lyell forwards, half are *literally* quoted by Whewell (but without quotation marks).⁶⁶

First, That there is a capacity in all species to accommodate themselves, to a certain extent, to a change of external circumstances, this extent varying greatly according to the species.

2dly. When the change of situation which they can endure is great, it is usually attended by some modifications of the form, colour, size, structure, or other particulars; but the mutations thus superinduced are governed by constant laws, and the capacity of so varying forms part of the specific character.

3dly. Some acquired peculiarities of form, structure, and instinct, are transmissible to the offspring; but these consist of such qualities and attributes only as are intimately related to the natural wants and propensities of the species.

4thly. The entire variation from the original type, which any given kind of change can produce, may usually be effected in a brief period of time, after which no farther deviation can be obtained by continuing to alter the circumstances, though ever so gradually [...]

[5thly]

6thly. From the above considerations, it appears that species have a real existence in nature, and that each was endowed, at the time of its creation, with the attributes and organization by which it is now distinguished. [*Principles*]

It may be considered, then, as determined by the over-balance of physiological authority, that there is a capacity in all species to accommodate themselves, to a certain extent, to a change of external circumstances; this extent varying greatly according to the species. There may thus arise changes of appearance or structure, and some of these changes are transmissible to the offspring; but the mutations thus superinduced are governed by constant laws, and confined within certain limits. Indefinite divergence from the original type is not possible; and

⁶⁵ *History* iii.552,556,568,593,570.

⁶⁶ *Principles* ii.64-5; *History* iii.575-6.

the extreme limit of possible variation may usually be reached in a short period of time: in short, *species have a real existence in nature*, and a transmutation from one to another does not exist. [*History of the Inductive Sciences*]

Whewell's use of Lyell in non-acknowledged passages should not be seen as plagiarism. Although he often forgets to acknowledge his borrowing of passages, at the same time one can easily find numerous passages where he frankly refers to Lyell's history. On the whole Whewell's working methods were not very systematic, and his references, even to his own writings, are particularly haphazard and vague.⁶⁷ It is important to note, however, that even his use of acknowledged material from Lyell's books does not serve to show Lyell's opinions, but his own. For example, in the passage above Whewell does not present the conclusions as Lyell's. He speaks of "physiological authority" and in the lines leading to the passage he states that there is "an indisputable preponderance to that decision which rejects the transmutation of species." Lyell's refutation comfortably suited Whewell's religious preconceptions.

The relation of geology and religion

In defining palaeontological science as the study of the causes of change from the past down to the present, Whewell insists that the historical records of man are of great consequence. This principle, he writes, has been tacitly recognized in geology, although the collection on a grand scale of such facts has only started with the research of Karl Von Hoff in *Geschichte der durch Ueberlieferung nachgewiesenen natürlichen Veränderungen der Erdoberfläche* (1822-24), and perfected by the inquiries of Lyell. But this principle introduces man's historical writings as well, which tell about the "the formation of the earth and its population, and a subsequent deluge," events not without interest for geology. How to interpret these writings is matter of controversy and "we may have to compare and to reconcile the evidence of the existing phenomena with that of historical tradition."⁶⁸ Whewell is not going to shun the irksome task of explaining the difficulties which the reconciliation of science with Scripture presents. And in doing this he works out a system of reasoning which in Lyell, Buckland or Sedgwick remained a mere statement that science and religion are different fields which must at all costs be kept apart. As this reasoning underlies all of Whewell's suppositions about palaeontological science, a closer look at it is essential for a complete understanding of his objections to uniformitarianism.

The existence of man can be studied either palaeontologically or morally. Man's moral ideas lead to the certainty of all that religion stands for:

⁶⁷ See *LLWi*.vii, i.104-6.

⁶⁸ *Philosophy* i.681.

that his moral faculties were bestowed upon him by design and for a purpose; that he is the subject of a Moral Government; that the course of the world is directed by the Power which governs it, to the unfolding and perfecting of man's moral nature; that this guidance may be traced in the career of individuals and of the world; that there is a *Providential* as well as a Natural Course of Things.⁶⁹

As the economy of the world presents evil as well as goodness, it is only natural that man should look for a confirmation of his highest hopes elsewhere. These he finds in the sacred narrative, the existence of which confirms the providential order of things.

Nevertheless, Scripture presents difficulties: it speaks of the beginning of things, a course of the world entirely different from the present, on which point its language appears "obscure and mysterious, perhaps ambiguous and seemingly contradictory." This, however, should not be a matter of surprise as it must perforce "speak of objects and occurrences in the words and phrases which have derived their meaning from their application to the existing natural state of things." The progress of science inevitably causes controversy as the language of Scripture is adapted to man's pre-scientific intellectual state. Hence the phrases used by Scripture are precisely those which science soon teaches man to consider as inaccurate.⁷⁰ The controversies caused by science are understandable, though, as it seems to attack the providential relations of man, which are far more important to him than facts from nature.

Thus, man is extremely reluctant to give up any traditional interpretation of any part of the Scriptures. A new interpretation, however, must not be eschewed when scientific theory is proved true. Man must at all times be consistent with what he knows, and given the above restrictions of the language of the sacred narrative, a different understanding of a certain passage is required in which he must reconcile it with the language of science. It is important in questions like these, Whewell warns, to proceed "at a proper season, and in a proper spirit," decide after long deliberation so as not to "distress without need,"⁷¹ and one should always keep in mind that scientific exactness does not touch the acceptance of revelation in the least.

Another source of difficulty is that, by the very nature of their investigation of the past history of the earth and its inhabitants, the palaeontological sciences induce the scientist to contemplate a beginning of things. Exact knowledge about this beginning, however, can by no means be arrived at by reasoning from the known course of nature. There is always a point where we find ourselves separated from an order of things totally different from anything we can experience. Whewell doubts whether it will ever be possible to reach conclusions to such questions "without having recourse to other grounds of truth," and that one should consequently look for a different kind of evidence

⁶⁹ *Philosophy* i.682.

⁷⁰ *Philosophy* i.684,686.

⁷¹ *Philosophy* i.689,690.

than that which falls within the province of science.⁷² Science cannot contradict anything in Scripture on the creation: “the providential history of the world has its own beginning, and its own evidence.”⁷³

All the same, the geologist can go back very far and “ascend to a point which [...] seems to be near the origin.” But as the palaetiological sciences are linked to other kinds of research, which lead to the study of the internal faculties of man, comprising his thought, conception of right, love of beauty and so on, geology cannot be expected to furnish answers as to the beginning of things all by itself, but rather should combine with moral and mental speculations in a rough estimate of the place and nature of the creation, all of which supersedes the reasoning of the separate sciences. Geology, therefore, is not allowed to speculate about a mere physical beginning of things. This conclusion, Whewell hastens to add, “has not been sought for, from a wish to arrive at such conclusions,” but follows logically from the classification of geology as a palaetiological science “and this classification was framed from an unbiased consideration of the general analogies and guiding ideas of the various portions of our knowledge.”⁷⁴

With this kind of reasoning Whewell seems to put the work of reconciliation of Genesis with the geology of the scriptural geologists on a formidable philosophical basis. The impression is fallacious, though, as a prerogative of true science is to follow its own principles throughout. If precepts extraneous to the science in question are allowed to operate, the science loses its philosophical basis. Thus, geology and theology must be kept apart, otherwise both will lose. This axiom we have already encountered in Lyell’s and Sedgwick’s opinions of Mosaic geology, but without the clarity of Whewell’s exposition, who seems to fear more for religion than for science:

It is in the highest degree unwise in the friends of religion [...] unnecessarily to embark their credit in expositions of Scripture on matters which appertain to natural science. By delivering physical doctrines as the teaching of revelation, religion may lose much, but cannot gain anything.⁷⁵

and he clarifies that

the two sciences may conspire, not by having any part in common; but because, though widely diverse in their lines, both point to a mysterious and invisible origin of the world [...] The error of persons who should seek a geological narrative in theological records, would be rather in the search itself than in their interpretation of what they might find.⁷⁶

⁷² *History* iii.582.

⁷³ *Philosophy* i.688.

⁷⁴ *History* iii.583.

⁷⁵ *Philosophy* i.692-3; the idea was put forward as early as Review (1832), p.117.

⁷⁶ *History* iii.584,587.

This, of course, also includes the contrary, namely that it is unphilosophical to conclude against a supernatural beginning on geological grounds:

As men who make the science of Truth the business of their lives, and we are persuaded of her genuine superiority, and certain of her ultimate triumph, they are peculiarly bound to urge her claims in a calm and temperate spirit; not forgetting that there are other kinds of truth besides that which they peculiarly study.⁷⁷

To sum up, palaetiological sciences do not include, but point to, a first cause.

The purpose of all this reasoning becomes clear when Whewell moves next to a discussion of the First Cause. This First Cause must be identified with God, as the mind of man is so constituted as not to accept a mere series of successive causes and effects, dependent upon one another, without beginning or end, as a self-sufficient First Cause:

to say that the mind *cannot thus be satisfied*, appears to be equivalent to saying that the mind is conscious of a Principle, in virtue of which such a view as this must be rejected.⁷⁸

The argumentation is presented in such a way as to press this truth mainly on geological theory, and it thus betrays Whewell's real difficulties with a supposed uniformity of nature. It simply does not square with man's idea of providence and seems to reduce everything to a mere force of nature.

At an early point in his career Whewell had denied that the discovery of general laws in the events of nature move the presence of the Creator to a greater distance. In an essay jotted down in an unpublished private notebook⁷⁹ he writes that it is a common fallacy in science to conclude from the discovery of laws "the course of nature to be self-subsisting and self-permanent," that the discovery of laws is proof of "a perpetually proceeding series or cycle of physical events and appearances" which dispenses with "the necessity for a perpetually and preserving providence in the world." This kind of reasoning takes laws or rules for agents, while in reality they exist in the mind of the researcher and nowhere else. Its value does not lie in this direction. Rather, where the scientist is convinced of having deduced the laws truly from nature and feels exulted with such a feat, there must be "some meaning and origin beyond ourselves." They must also be the laws which "have prevailed in the mind of an intelligent being by whom the material world is governed," as they cannot be traced to any other origin, and thus they become:

the characters which He has stamped upon His productions and which we are enabled to read. With us [...] they are the knowledge of the language in which

⁷⁷ *Philosophy* i.694.

⁷⁸ *Philosophy* i.703.

⁷⁹ The essay, entitled "Reflections on God," dated Sunday, November 13, 1825, is given in *LLW* i.360-65.

the book of nature is written. And this language is the expression of His thoughts, and we can read it so far as our minds are of the same nature with His.

Whewell here uses the language metaphor, which is prominent in so much scientific writing of the period, to its full potential. It subordinates the importance of the study of nature to religious sentiment:

Every new law that we discover does thus, in proportion to its generality, bring us nearer and nearer knowledge of the thoughts of God as they regard the material world, and the pursuits of science acquire a dignity and an importance which almost invests them with a religious awe.

This religious sentiment predisposes Whewell's mind against the "perpetually proceeding series or cycles" of uniformitarianism.

Whewell here has his finger on the difficulty of reconciling uniformity with Scripture, a point that seemed to push Lyell into the direction of the deist. But even here, Whewell writes in the *Philosophy*, the conception of the order of existence as a whole must be seen as a single effect, which in its turn must have had a single cause. Thus we reason towards God as a necessity *a posteriori*. At the same time this kind of inquiry is based on an *a priori* assumption of the existence of the deity through our ideas, and the proof we find of it confirms our ideas. This is the mainspring of reasoning in natural theology. The existence of a designer is "assumed in order that the phenomena may become intelligible to the mind."⁸⁰ It is imperative for the progress of the palaeological sciences, all of which point to the same origin of things, but, of course, without leading to it themselves.

Thus, for example, man cannot accept the theory of transmutation on both religious and scientific grounds. In 1837 he had written that

if we allow such a *transmutation of species*, we abandon that belief in the adaptation of the structure of every creature to its destined mode of being, which not only most persons would give up with repugnance, but which, as we have seen, has constantly and irresistibly impressed itself on the minds of the best naturalists, as the true view of the order of the world.⁸¹

This is one of the few examples where Whewell expresses an emotional feeling of disgust in giving up the idea of divine order in the plan of the creation. He was too intelligent to make this a leading argument against uniformity or transmutation, but it seems to be the reason behind *Indications of the Creator*, a small octavo volume published in 1845 containing extracts from both the *History* and the *Philosophy*. The selected passages are on astronomy, physiology, and geology, and tend to demonstrate the reality of a beginning of things and its first cause. The event which occasioned the book is disclosed in a letter to J.F.W. Herschel:

⁸⁰ *Philosophy* i.706.

⁸¹ *History* iii.574.

I do not know if you have seen or heard [...] of a book called *Vestiges of Creation*. It is anonymous, has been circulated with great zeal and mystery, and is much read and talked of. It is considered to have a materialist tendency, and so, to be mischievous. I have been much urged to answer it, which I have refused to do, except by extracting passages from my previous books; and indeed, in the passages which I have extracted, all the arguments of the *Vestiges* are discussed and answered.⁸²

In the preface to *Indications* Whewell presents his writings in the *History* and the *Philosophy* as natural theology, but of a different kind from that of other writers, who usually set out with a predetermined theological conclusion. They are suspected of “a defect of candour and comprehensiveness.” The passages in *Indications* arise from “a narrative of the whole History of Science, and an analysis of the processes by which sciences have been formed.”⁸³

On the question of the logic of natural theology, Whewell is, in fact, more consistent than the other geologists under discussion. Thomas McPherson in his historical study of the argument from design distinguishes four approaches: (1) from order to a designer; (2) from order to purpose to a designer; (3) from purpose to a designer; (4) from order or purpose not distinguished to a designer.⁸⁴ Sedgwick and Buckland, and even Lyell, seem to take purpose in order for granted and in thus following the third approach assume what they want to see proved. Whewell follows the more profitable way of the second approach: he establishes the existence of order, distinguishes mere order from order displaying purpose, and reasons from this to a designer. He writes that in arguing from design we should not content ourselves with declaring that, as parts make up an organized whole, the parts are mutually dependent. In arguing for purpose one should be able to reason also the other way round, viz. that the whole gives meaning to the parts. Whewell exemplifies this in the case of an arch: the bricks are mutually dependent in forming the arch, but the bricks remain bricks when separate. Purpose is found in a limb, which has no properties when separated from the body. Similarly, mutual causes and effects, as in a rock sliding down a slope, do not suffice in the argument; the effects taking place in a whole should be “essential to our conception of the whole.”⁸⁵ In such a whole we see organization of a different type from mere coincidence. We can speak of intended effects only when the effects are included in the *idea* of an object.

Whewell does not deduce design from facts, however, but it is assumed as a prerequisite to scientific reasoning. As we do not deduce the ideas of time and

⁸² March 12, 1845, *LLW* ii.325.

⁸³ *Indications of the Creator*, p.viii.

⁸⁴ *The Argument from Design*, p.10; McPherson sees the first approach as the purest form as “it is not open to the charge that the conclusion is assumed,” but allows that “it is a difficult line to follow.”

⁸⁵ *Philosophy* i.619.

space from facts, but consider them subordinate to these concepts, design too is a fundamental idea, a “principle which connects, includes, and renders them intelligible.”⁸⁶ This is not to say that Whewell assumes what he wants to prove. He assumes an idea of design while design in objects must be proved on the principles of this idea. Thus when design is found, the facts, coming from without, square perfectly with the principle, coming from within. The argument from design seems more important as a scientific principle than as religious evidence for providence. The latter is taken for granted.

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Up to 1845 Whewell had found philosophical inconsistencies in the theory of uniformity with the conceived idea of providence. But as even an advocate such as Lyell admitted that the introduction of man was of an order different from other acts of creation, the place of man in nature was never questioned. Lamarck’s idea that man had developed out of “petits corps gelatineux” could be talked of with irony in the 1832 Review as making the reader “somewhat giddy with this unexpected elevation.”⁸⁷ No one seriously seemed to doubt that

man’s history only begins, where that of other animals ends, with his mere existence. They are stationary, he is progressive. Other species of animals, once brought into being, continue the same through all ages; man is changing, from age to age, his language, his thoughts, his works.⁸⁸

Vestiges changed all that. The irony is gone in *Indications*: Chambers’s book imperilled the status of man in the creation, and with it the highest proof of design. It is therefore a very different product from the works from which it was drawn. Its emphasis is altogether different and belongs more properly to scriptural science than anything else Whewell had written. The conclusion of the book is worth giving: “In the Beginning was the Word, and the Word was with God, and the Word was God.” This reveals that Whewell had never lost sight of what he had attempted in a series of sermons back in 1827, namely “to make science fall in with a contemplative devotion.”⁸⁹

⁸⁶ *Philosophy* i.620-21.

⁸⁷ Review (1832), p.114.

⁸⁸ *Philosophy* i.657.

⁸⁹ Letter to Richard Jones, February 26, 1827, *LLW* ii.82-3.

PART THREE
THE MEN OF LETTERS

CHAPTER ELEVEN

SWINGING MID-AIR AMONG THE PRECIPICES OF LIFE

To the professional scientists geology was a heroic and romantic quest for the history of the earth, a voyage through distant new worlds peopled by legendary monsters and ruled by unknown powers. Palaeontology in particular lent itself to mythic description; William Whewell wrote in the *History of the Inductive Sciences* that “there is no branch of human knowledge more fitted to stir men’s wonder.”¹ Geology proper, too, talked of change which could be comprehended only on a Miltonic scale: thus not only did Buckland and Lyell quote from *Paradise Lost* in their geological descriptions, but Whewell actually reviewed *Principles of Geology* through it for the *British Critic*:

Mr. Lyell has attempted to lead us through the realms of Night and Chaos: to construct

A broad and beaten way
Over the dark abyss, whose boiling gulf
Tamely endures a bridge of wond’rous length,
From hell continued, reaching the utmost orb
Of this frail world.²

The element of marvel in geological discovery is prominent too in the various fugitive poems on geological discovery written, often for private circulation, by professional and amateur scientists alike; for example in the poem by William Conybeare describing Kirby Hole “with Buckland to tell of its glories”:

Ages long ere this planet was formed,
(I beg pardon, before it was drowned,)
Fierce and fell were the monsters that swarmed,
Roared and rolled in these hollows profound.³

The geologist had become a knight in fairy-land from the moment William Buckland, geologizing on horseback, carried a gigantic ammonite found with its inner whorls gone around his neck, and was dubbed by his fellow geologists the *Ammon-Knight*.⁴ No doubt, geological fieldwork had a strong element of

¹ iii.513.

² Review (1830), p 193; Whewell’s quotation is from *Paradise Lost* ii.1026-9.

³ “On the Hyænas’ Den at Kirkdale, near Kirby Moorside, in Yorkshire, discovered A.D. 1821,” (Daubeny, *Fugitive Poems*, pp. 92-4).

⁴ Richard Whately starts his “Elegy Intended for Professor Buckland” with: “Mourn, Ammonites, mourn o’er his funeral urn,/ Whose neck ye must grace no more” (Daubeny, *Fugitive Poems*, p.88).

adventure in it. One only needs to read Lyell's letters and journals of his Italian journey in 1828-29 to realise that research could involve physical hardship and even danger.

The new identity of the science of geology also had repercussions on the religious sentiments of the English public at large and some of its more emblematic discoveries became proper vehicles for poetic expression. Not only scientists but also men of letters seized the poetic possibilities of the imaginative side of geology. John Henry Newman, for example, wrote that geology had a quality which opened "an amazing field to imagination and to poetry."⁵ In fact, Alfred Tennyson relied much on his geological knowledge in *In Memoriam* and Elizabeth Barrett Browning used it in *Aurora Leigh*. Novelists as far apart as Disraeli, Gissing, George Eliot and Hardy used geology in their novels. Moreover, a general interest of the reading public in geology is reflected in such popularizers of science as Charles Kingsley and the elder Gosse.

What struck the public most was the new vista of geological time which complemented the astronomical sense of vastness in space and thus led to a further humbling of man's importance in the plan of the creation. Tennyson is often seen as the spokesman of the religious crisis that geological discovery caused in the mind of the Victorian, but the immensity of geological time was interpreted in very different ways by different artists. Although the clash with orthodox religious sentiments was often painful, the process of hubris was not always negative in the end. Many saw a magnificent philosophical power in such a length of time, others saw it as a force which liberated man from his too-narrowly anthropocentric obligations. On the whole, the hysterical alarm of the Mosaic geologists was not part of the literary tradition.

*

The *locus classicus* for the reaction to geology is a passage in Benjamin Disraeli's novel *Tancred* (1847). In historical accounts it is often quoted to show Disraeli's impatience and disgust with the influence of science over religion. Tancred's journey to the Orient is a quest for true religious values to replace the inadequate social role of the Anglican Church. For a moment he thinks he has found these values in the beautiful Lady Constance, until in a *tête-à-tête* she talks to him about the origin of life, about which she had read in *Vestiges of Creation*. Such a revelation of her character, of course, contrasted sharply with Tancred's spiritual crusade and is therefore treated with contempt:

"You know, all is development. The principle is perpetually going on. First there was nothing, then there was something; then, I forgot the next, I think there were

⁵ *Autobiographical Writings*, p.55.

shells, then fishes; then we came: let me see, did we come next? Never mind that; we came at last. And the next change there will be something very superior to us, something with wings. Ah! that's it: we were fishes, and I believe we shall be crows. But you must read it." [...]

"I was a fish, and I shall be a crow," said Tancred to himself, when the hall door closed on him. "What a spiritual mistress! And yesterday, for a moment, I almost dreamed of kneeling with her at the Holy Sepulchre!"⁶

This passage is often used by historians to show Disraeli's denigrating opinion of geology, but what is lost sight of in such an approach is the fundamental difference between the solid facts of geology and the wild speculations of *Vestiges* represented by Lady Constance. Milton Millhauser has pointed out that "Disraeli meant to ridicule, but his purpose was to characterize a foolish and fashionable young lady rather than to vent any personal spleen at the book, which he privately considered merely amusing."⁷ Such an approach is undoubtedly helpful, but it still tends to misrepresent Disraeli's purpose. *Vestiges* might have been amusing enough to the intellectual reading public, but it imperilled the decency of geology as a science. Many critics, in fact, have failed to stress that Disraeli wants to criticize the very same theory which got scorn from the most prominent scientists of the day including Lyell, Sedgwick, Owen and Whewell. To see Disraeli's outcry, therefore, either as against geology or against the lady's character is to misread the scientific context. What needs emphasis is that the geologists would not have seen Disraeli's derision of the transmutation theory as an attack against their own persons. Sedgwick's reactions to transmutation are of a ferocity that goes well beyond Disraeli's mockery.

Moreover, Disraeli showed a positive interest in geology in his early novel *Vivian Grey* (1826-7). The contrast of emphasis in the following passage with the one in *Tancred* should suffice to make Disraeli's position clear. One of the spiritual mentors or father-figures, which crop up so often in Disraeli's fiction, asks Vivian Grey whether he can

conceive anything sublimer than the gigantic shadows and the grim wreck of an antediluvian world? Can you devise any plan which will more brace our powers, and develop our mental energies, than the formation of a perfect chain of inductive reasoning to account for these phenomena? What is the boasted communion which the vain poet holds with nature compared with conversation which the geologist perpetually carries on with the elemental world? Gazing on the strata of the earth, he reads the fate of his species. In the undulations of the mountains is revealed to him the history of the past; and in the strength of rivers and the powers of the air he discovers the fortunes of the future. To him, indeed, that future, as well as the past and present, are alike matter for meditation.⁸

⁶ *Tancred*, bk ii, ch 9, pp.149-150.

⁷ "The Literary Impact of *Vestiges of Creation*," p.214.

⁸ *Vivian Grey*, bk iv, ch 4, pp.315-16.

Geology in *Vivian Grey* is a mighty instrument to contemplate the past, present and future of an anthropocentric world, while Lady Constance's geology in *Tancred* reduces man to a mere cog in the machine of development, which although now at the top will in time be far below a superior race:

Everything is proved: by geology, you know. You see exactly how everything is made; how many worlds there have been; how long they lasted; what went before, what comes next. We are a link in the chain, as inferior animals were that preceded us: we in turn shall be inferior; all that will remain of us will be some relics in a new red sandstone. This is development. We had fins; we may have wings.⁹

It was the status of man that caused the greatest obstacles in a fair discussion of transmutation before *The Origin of Species* and, indeed, to some extent after it. Sedgwick and Whewell could not see man otherwise than directly and expressly created by the divine fiat, and although capable of intellectual and moral improvement, not subject to change as a biological species. Lyell was as orthodox in this as Sedgwick and Whewell. When he became aware of where Darwin's research in the late 1850s was leading and started to contemplate the possible inferiority of present man to future man, he found the idea unbearable. Disraeli shared this outlook.

If to William Thackeray geology in the 1820s was still the hobbyhorse of the retired country-gentleman unheroically closeted with his fossils and minerals, to Benjamin Disraeli it was a philosophical vehicle for the study of mankind. Thus Mr Eagles in *Vanity Fair* is a rather denigrated geologist—

"If you were a man of any spirit, Mr. Eagles, you would box the wretch's ears the next time you see him at the Club," she said to her husband. But Eagles was only a quiet old gentleman, husband to Mrs Eagles, with a taste for geology, and not tall enough to reach anybody's ears.¹⁰

—whereas to Vivian Grey geology is recommended as "indeed a magnificent study! What excites more the imagination? What exercises more the reason?" and the geologist becomes

the most satisfactory of antiquarians, the most interesting of philosophers, and the most inspired of prophets; demonstrating that which has past by discovery, that which is occurring by observation, and that which is to come by induction.¹¹

Time's new dimensions almost stretching into infinity are reflected in Robert Browning's idea of the universe. But although Browning shared the religious outlook of many of his contemporaries, his sense of a God beyond man's reach did not depend on geological discoveries. His vision of the universe includes the creation in all its plenitude in which the presence of the

⁹ *Tancred*, bk ii, ch 9, pp.149-150.

¹⁰ *Vanity Fair*, ch 64, p.745.

¹¹ *Vivian Grey*, bk iv, ch 4, pp.315-16.

divinity is something mysterious and distant with a personality with which it is difficult to come to terms. In this Browning is the typical example of the Victorian who struggled with the idea of a present but obscure divinity. It squared well with the Lyellian world view: God exists and rules the world, but his direct intervention is impossible to contemplate. Thus in "Paracelsus" (1835) Browning calmly uses geological observations for the description of the "everlasting bliss" which is nearest to what we can define as the godhead:

The centre-fire heaves underneath the earth,
The molten ore bursts up among the rocks,
Winds into the stone's heart, outbranches bright
In hidden mines, spots barren river-beds,
Crumbles into fine sand where sunbeams bask—
God joys therein.

Geological change on the earth's surface is as much part of God's presence as the spring-wind, chrysalids impatient for the air, or birds in merry flocks:

Thus he dwells in all,
From life's minute beginnings, up at last
To man.¹²

To read, however, in nature positive indications of the quality of the divine essence rather than mere evidence about its existence, calls forth nothing but scorn in Browning. Such a deistic fallacy is brought home by the superb irony of "Caliban Upon Setebos" (1864) where Caliban concludes from fossils that the Creator turned his creations into stone out of envy:

'Dug up a newt He may have envied once
And turned to stone, shut up inside a stone.

Thomas Moore found in geology a fit vehicle for satire. In his "Anticipated Meeting" (1836) he made use of geological knowledge to such an extent that Lyell wondered where he got it from. William Henry Fitton disclosed that Moore's immediate source was the meeting of the British Association that year in Bristol.¹³ "Anticipated Meeting" is an account of a meeting of the British Association in the year 2836 during which a Mr Tomkins presents the discovery of two fossil creatures by then extinct, bishops and peers,

But which Tomkins more erudite names bestow'd on,
Having call'd the Peer fossil the' Aristocratodon,
And, finding much food under t'other one's thorax,
Has christen'd that creature the' Episcopus Vorax.

The examination of the contents of the stomachs of these pre-historic creatures

¹² *Paracelsus*, v.653-59,681-84.

¹³ Charles Lyell to his father, October 4, 1836, *LLL* i.473.

is well-ground in geological practice and terminology. The poem is a good example of radical fiction of the period: a peer without a coronet was

near akin to the *genus humanum*
And the' experiment, tried so successfully then,
Should be kept in remembrance, when wanted again.

*

In the 1840s and 1850s, religious introspection pervaded literature, and religious doubt became a proper subject for the novel. Even many a churchman who was not primarily a novelist ventured to preach through this medium. The theological basis of the Anglican Church was examined and defended by a number of orthodox writers, male as well as female. Novelists like William Gresley, Catherine Long and Francis Edward Paget belong to this school. They wrote tales of warning in which minds led astray by dissent are brought back to the Church. Their tone is high and dry, their fiction often mere preaching. At the same time the novel became a proper vehicle for the analysis of doubt and conversion. The novelists here are of greater calibre and had a more interesting story to tell than early High-Church fiction. Amongst them we have John Henry Newman who published the story of his conversion to the Roman Catholic Church in *Loss and Gain* (1848) and James Anthony Froude's doubts in *The Nemesis of Faith* (1849). They opened the way for other religious writers, such as Charles Kingsley and Elizabeth Gaskell, and they strengthened the introspective element of the novel in general.¹⁴ Church matters were of such interest that even artists like George Eliot and Anthony Trollope in the late 1850s published tales about clerical life.

We might expect geology to feature prominently in the novel of religious doubt in the 1840s and 1850s. However, the pre-Darwinian novel is remarkably undisturbed by scientific discoveries, while it is in the post-Darwinian novels written by such doubters as Samuel Butler, Mark Rutherford, Winwood Reade and George Gissing, that geological discovery comes to the fore. It seems that the reading public needed to be confronted with evolution before they could properly interpret the contribution of geology to the decay of faith. Thus in the priggish novels of William Gresley the influence of geology or even science in general on orthodoxy is completely overshadowed by questions on church matters. Although the main character of *Bernard Leslie; or a Tale of the Last Ten Years* (1842) is made to say that he "did not neglect the various opportunities afforded of attending [at Oxford] lectures in chemistry, botany, anatomy, geology, and other branches of information, which are too commonly

¹⁴ Compare Tillotson, *Novels of the Eighteen-Forties*, p.131.

passed over by students at the university,”¹⁵ he is never troubled by any of their discoveries. The absence of any reference to geological discovery, belying the subtitle, squares awkwardly with Gresley’s emphasis on the literalness of the Scriptures:

The Anglican Church founds her doctrines solely on Scripture, and requires nothing to be believed as an article of faith which may not be proved thereby. Therefore in searching Scripture we are but following the Church’s instruction. She challenges inquiry, and is confident of the result.¹⁶

Sure enough, the true doctrines of the Anglican Church are imperilled, but not by science:

Church principles have been neutralized by those of dissent, and popery, and infidelity. The self-will and arrogance of sectarianism, the bad faith of Romanism [...] the dark malignity of infidelity, and, still more dangerous, because more subtle and more plausible, that deadly indifference to all religion, which lurks under the garb of liberalism,—these have obtained an influence, nay, almost an ascendancy, which has been effective of the deepest injury to this our generation.¹⁷

This stand remains unchanged in a sequel published 17 years later in 1859.¹⁸

Again, from a novel of doubt like J.A. Froude’s *Nemesis of Faith* (1849) we would expect much on the influence of geology. It is surprising, therefore, that it does not seem to have had any tangible influence on Markham Sutherland’s process of loss of faith. A series of propositions leads to Sutherland’s rejection of the Bible and the Anglican creed; one of his propositions is as follows:

That historical criticism, that scientific discovery *have uniformly tended to invalidate* the authority of histories to which the infallible church has committed herself. Granted [...] Now if these things were facts, taken alone at least, they were unquestionably serious. Happily I had very early learned the fallacy of building much on logic and verbal argument. Single sets of truths I knew to be as little conclusive in theology as in physics; and, in one as in the other, no theory to be worth anything, however plausibly backed up with Scripture texts or facts, which was not gathered *bonâ fide* from the analysis of all the attainable phenomena, and verified wherever possible by experiment.¹⁹

On the whole, Sutherland is rather belittling about the importance of science and reason: “reason was not the whole of us; and alone it must ever lead to infidelity.”²⁰ Compare also:

¹⁵ Bernard Leslie; or, *A Tale of the Last Ten Years*, p.2.

¹⁶ *Portrait of an English Churchman*, pp. 108-9.

¹⁷ *Portrait*, p.78.

¹⁸ “Even at the present time, when we look at the multiplication of sects, the violent opposition to the Truth, the worldliness which prevails everywhere, the crime which abounds, who does not sometimes fear, lest the combined influence of these antagonistic elements should overwhelm and crush the Church?” (*Bernard Leslie. Part Two*, p.228.)

¹⁹ *The Nemesis of Faith*, pp.145,146.

²⁰ *Nemesis*, p.148.

I confess it sickens me to see our philosophic savan[t]s, as they call themselves, swinging in this way mid-air among the precipices of life, examining a flower here, a rock there; analysing them and cutting them in pieces, and discovering the combination of elements which went to their making, and calling this *wisdom*. What is man the wiser or the happier for knowing how the air-plants feed, or how many centuries the flint-stone was in forming, unless the knowledge of them can be linked on to humanity, and elucidate for us some of our hard moral mysteries.²¹

Scientific knowledge is ignored to the extent that the narrator actually limits man's time on earth to 6,000 years:

Markham's heart had more in it than blood, and his nature was either too weak or else too genuine to find its cravings satisfied, when he had resolved the great life of humanity, these six thousand years of man's long wrestle with the angel of destiny, into a cold system in which he could calculate the ebb and flow as on the tables of a tide.²²

In describing everything that was wrong in his time with religion he does indeed furnish a long list, but recent geological discoveries do not feature there. If Scripture does not give one unambiguous message man can trust, then Sutherland prefers to renounce it. If the interpretation of the Bible is just a wordgame, then it is nothing at all. But this quest for the value of the Bible is not linked to any light geology might have shed upon its truth.

In *Loss and Gain* (1848) John Henry Newman does not discuss geology with regard to theology either, but concentrates on the theological differences between the Anglican and the Roman Church. The University of Oxford, he explains, has always been a place of fashions, and the heyday of the fashion for geology is over: "once geology was all the rage; now it is theology."²³

As one of the greatest nineteenth-century theologians, his views on geology and science are worth investigating. Early on during his stay at Oxford he showed an interest in geology. He started attending Buckland's lectures in 1819 and in his Second Autobiographical Memoir he recorded how in March 1821 he visited a gentleman at Abingdon with a fine collection of minerals and was "employed in looking over them from one to four o'clock." Much impressed he decided to "make various excursions to the British Museum [...] for the sake of the minerals." In the same Memoir he noted down in June that during the Lent term he had attended Buckland's course of lectures—"most entertaining, [...] an amazing field to imagination and to poetry"—and he had made "a careful analysis of them."²⁴ Especially the geological age of the earth seems to have intrigued him. On June 5, for example, he writes in a notebook that

²¹ *Nemesis*, pp. 85-6.

²² *Nemesis*, p.96.

²³ *Loss and Gain*, pp.30-31.

²⁴ *Autobiographical Writings*, pp.54-5; in a contemporary notebook he jotted down that in 1821 "mineralogy was my principal pursuit," (*ibid.* p.181).

Buckland has just noticed in his geological lecture the extraordinary fact, that, among all the hosts of animals which are found and are proved to have existed prior to 6000 years ago, *not one* is there which would be at all serviceable to man; *but* that directly you get within that period, horses, bulls, goats, deer, asses &c are at once discovered. How strong a presumptive proof from the face of nature of what the Bible asserts to be the case.²⁵

In June he wrote to his mother that he could not spare the time necessary for attending Buckland's lectures any longer. This decision might have been dictated by a growing inclination to take holy orders. His notebooks, however, show that he continued going to the professor's lectures both during the Lent and Michaelmas terms of 1821 and that Buckland's teaching did not leave him indifferent in terms of its religious implications. In October of that year he jotted down in his notebook several reasons in favour of the Mosaic 6,000 years.

In 1822 he decided to stand for an Oriel fellowship. Because of this his interest in geological studies diminished. Once a fellow of Oriel, he attended a course by Charles Lloyd, Regius Professor of Theology, on Sumner's *Records of the Creation* in 1823-4, but by then his concern is evidence for faith rather than scientific theory. There is no indication that he ever went to Buckland's lectures again.

To Newman faith was an inward contemplation of the soul answering a moral message from beyond the material world which induces man to religion and reprimands sin. Natural theology, because based on the outward world, can have no meaning for the believer: "I believe in design because I believe in God, not in God because I can see design."²⁶ Reason does not lead to faith, although "the department of fact, and the method of research and experiment which is proper to it, may for the moment eclipse the light of faith in the imagination of the student."²⁷ He did not deny that a scientific attitude to faith had discomforted many believers and that in the perusal of science there is a tendency to "make men indifferentists or sceptics, merely by being *exclusively* pursued."²⁸ The error of such persons is that they confound the inward light of faith with the outward search for facts. "They imagine that the eternal, immutable word of God is to quail and come to nought before the penetrating intellect of man."²⁹ And of geology in particular he remarks:

let him learn from the geologist, that on that globe of ours enormous revolutions have been in progress through innumerable ages [...] let him take in and master the vastness of the view thus afforded him of Nature, its infinite complexity, its awful comprehensiveness, and its diversified yet harmonious colouring; and then, when he has for years drank in and fed upon this vision, let him turn round

²⁵ *Autobiographical Writings*, p.167.

²⁶ *Letters and Diaries*, xxv.97.

²⁷ "A Form of Infidelity of the Day, 1854," in *Lectures and Essays on University Subjects*, p.320.

²⁸ "Form of Infidelity," p.323 (emphasis mine).

²⁹ "Form of Infidelity," p.322.

to peruse the inspired records, or listen to the authoritative teaching of Revelation, the book of Genesis [...] and he may certainly experience a most distressing revulsion of feeling,—not that his reason really deduces any thing from his much loved studies contrary to the faith, but that his imagination is bewildered, and swims with the ineffable distance of that faith from the view of things which is familiar to him, with its strangeness, and then again its rude simplicity, as he considers it, and its apparent poverty, contrasted with the exuberant life and reality of his own world.³⁰

If the facts of geology substitute the inward contemplation of the soul, even for a moment, this might have a bewildering influence on the imagination which lies at the core of all religious sentiment. The power of the imagination—Lyell often stressed the impact of geological discovery on it—lies deep in Newman's approach to faith:

First comes Knowledge, then a view, then reasoning, and then belief. This is why Science has so little of a religious tendency; deductions have no power of persuasion. The heart is commonly reached, not through the reason, but through the imagination [...] Many a man will live and die upon a dogma: no man will be a martyr for a conclusion.³¹

That imagination fed by prejudice can have a persistent influence on religion is recorded in *Apologia Pro Vita Sua* (1864) when he writes of the influence of reading Thomas Newton³² as a boy in 1816 which made him identify the Pope with Antichrist: "My imagination was stained by the effects of this doctrine up to the year 1843; it had been obliterated from my reason and judgment at an earlier date; but the thought remained upon me as a sort of false conscience."³³

Newman, therefore, has no difficulty in a liberal attitude to scientific enquiry as long as it is applied to the domain of science. Moreover, truth cannot be contrary to truth and "it is the highest wisdom to accept truth of whatever kind, wherever it is clearly ascertained to be such, though there be difficulty in adjusting it with other known truth."³⁴ But the process of adjusting scientific to religious truth is a doubtful one and "not a few instances occur of this mistake at the present day, on the part, not indeed of men of science, but of religious men, who, from a nervous impatience lest Scripture should for one moment seem inconsistent with the results of some speculation of the hour, are ever proposing geological or ethnological comments upon it."³⁵ The university is called upon to see to it that no branch of studies leaves its own domain: its

³⁰ "Form of Infidelity," pp.325-326.

³¹ *Discussions and Arguments on Various Subjects*, p.292; quoted in Ker, *John Henry Newman*, p. 211.

³² Bishop of Bristol, author of *Dissertations on the Prophecies* (1754-8).

³³ *Apologia Pro Vita Sua*, prt 3, ch1, p.91.

³⁴ "Christianity and Scientific Investigation" (1855), in *Lectures and Essays on University Subjects*, p.271.

³⁵ "Christianity and Scientific Investigation," *op. cit.*, pp.285-86.

proper role is that of an umpire who “maps out the territory of the intellect, and sees that the boundaries of each province are religiously respected.”³⁶ In such a condition the person with faith is “not the nervous creature who startles at every sudden sound, and is fluttered by every strange or frightful appearance which meets his eyes [... and even] if anything seems to be proved by astronomer, or geologist, or chronologist, or antiquarian, or ethnologist, in contradiction to the dogmas of faith, that point will eventually turn out, first, *not* to be proved, or, secondly, not *contradictory*, or thirdly, not contradictory to anything *really revealed*, but to something which has been confused with Revelation.”³⁷ Newman shared the caution of most of the professional geologists, namely that man is all too easily led astray by his instinctive urge to build systems on an incomplete inductive basis:

The love of order and regularity, and that perception of beauty which is most keen in highly-gifted minds, has too often led men astray in their scientific researches. From seeing but detached parts of the system of nature, they have been carried on, without data, to arrange, supply, and complete. They have been impatient of knowing but in part, and of waiting for future discoveries.³⁸

The present state of knowledge hardly justifies meddling with revelation; what seems contradictory today, might in the future be in perfect accord. Scandal in scientific discovery should therefore be avoided and if “there is the chance of any current religious opinion being in any way compromised in the course of a scientific investigation, this would be a reason for conducting it, not in light ephemeral publications, which come into the hands of the careless or ignorant, but in the works of a grave and business-like character.”³⁹

³⁶ “Christianity and Scientific Investigation,” *op. cit.*, p.266.

³⁷ “Christianity and Scientific Investigation,” *op. cit.*, pp.277-78.

³⁸ “The Philosophical Temper, First Enjoined by the Gospel” (1826), in *Fifteen Sermons Preached before the University of Oxford*, p.9.

³⁹ “Christianity and Scientific Investigation,” *op. cit.*, p.287.

CHAPTER TWELVE

THE WHOLE CREATION GROANETH AND TRAVAILETH TOGETHER

Alfred Tennyson was not able to interpret or dismiss the implications of geological ideas with the ease of a Disraeli or a Browning. He did not share the novelist's stern Anglicanism or the poet's unwavering belief in a benevolent God. In Tennyson, it is true, faith is victor in the end, but one gets the impression that he rather "speaks like an archangel assuring the universe that it will muddle through."¹ His inability to refuse or accept the geological evidence for transmutation leads to a final belief that somehow man will evolve, that

A soul shall draw from out the vast
And strike his being into bounds,

And, moved through life of lower phase,
Result in man, be born and think,
And act and love, a closer link
Betwixt us and the crowning race.²

The distinction between a religious moral-intellectual improvement and transmutationist development of species is by no means as clear in *In Memoriam* as Tennyson might have wanted it to be. Embryonic development, which is implied in the soul moving "through life of lower phase," was one of the corner-stones of Chambers's development theory, and was much derided by Sedgwick.

Tennyson is often hailed as the poet of science, the man who spoke of evolution before Darwin supplied the explanation. This description, however, should not suggest any systematic approach, rational investigation or scientific thinking in the Baconian sense. Owen Chadwick has aptly stated that Tennyson "brooded over popular science with vague uncritical reflectiveness."³ It is true that Tennyson absorbed the leading theories of his time and was often enthralled by their discoveries, but his response remained emotional. He is often quoted as the typical example of the Victorian who was looking for "synthesis, generalization, and evaluation."⁴ Like so many other sensitive minds of his time, he was acutely aware that the progress of science advanced

¹ Young, *Portrait of an Age*, p.75.

² *In Memoriam*, epilogue.

³ Chadwick, *The Victorian Church* i.567.

⁴ Heyck, *The Transformation of Intellectual Life in Victorian England*, p.42.

at a bewildering rate and was steadily obscuring traditional creed and humbling the eighteenth-century anthropocentric view of the creation.

Tennyson is a good instance of the ambivalent reaction to nineteenth-century progress in science. As an ardent hobbyist⁵ he welcomed the new conclusions of science, but he realized at the same time that there existed an increasing incompatibility between reason and spirit:

This is a terrible age of unfaith. I hate utter unfaith, I cannot endure that men should sacrifice everything at the cold altar of what with their imperfect knowledge they choose to call truth and reason. One can easily lose all belief, through giving up the continual thought and care for spiritual things.⁶

At the same time he realized the poetic possibilities of the new scientific discoveries. He became acquainted at an early stage with astronomy and used the idea of infinite space in many of his poems. His studies of geology likewise provided him with the idea of the infinity of time. Both the ideas of time and space are central in Tennyson's search for man's—as well as God's—place in the plan of the creation.

Tennyson read *Principles* at the end of 1836 and the beginning of 1837 and was fascinated by it.⁷ In a letter to Richard Monckton Milnes, commenting on the approaching winter, he uses an image from *Principles* which proves his careful reading of it:

Truly we are getting deep into the great Geological winter and inasmuch as a round belly is better than a white head it were to be wished that we might wear down at the pole and grow up at the equator, that is, I would our waste were greater at the pole and that we had an eye to it at the equator.⁸

By adding a note he made sure that the allusion to Lyell was not lost to Milnes.

An idea of infinite vastness in which God seems to have disappeared and in which man is reduced to near nothingness recurs throughout his poetry. Connected with this is Tennyson's preoccupation with the limits of the human understanding and the limits of the imagination. "Dark is the world to thee, thyself is the reason why," Hallam records his father saying, and adds that "the real mysteries to him were Time, life, and 'finite-infinite' space":

⁵ In Farringford, for example, where Tennyson settled in 1853, he took up geology and "trudged out with the local geologist, Keeping, on many a long expedition" (*Alfred Lord Tennyson: A Memoir*, p.309).

⁶ *Memoir*, p.259.

⁷ Hallam Tennyson writes that his father was "deeply immersed" in "Lyell's *Geology*" (*Memoir*, p.136).

⁸ November, 1st 1836, *The Letters of Alfred Tennyson*, eds. Cecil Y. Lang and Edgar F. Shannon, Oxford 1982, i.145. Echoing Falstaff's lines in 2 *Henry IV*, Tennyson puns on Lyell's theory of climate, which is based on the concept that great quantities of land near the poles have a refrigerating tendency. Lyell availed himself here of the support of Herschel, who had argued that the movement of the earth slowly favoured a deepening of the seas in higher latitudes while the seas at the equator became shallower or even turned into land.

To your question now
Which touches on the workman and his work.
“Let there be light and there was light”: ’tis so:
For was and is and will be are but is:
And all creation is one act at once,
The birth of light; but we that are not all,
As parts, can see but parts, now this, now that,
And live perforce from thought to thought, and make
One act a phantom of succession: thus
Our weakness somehow shapes the shadow, Time.⁹

Tennyson was unquestionably interested in the workings of nature, not only for its own sake, but often as a manifestation of the glory of the Creator. Thus he is clearly a product of the Paleyan school of scientists-theologians. His son writes that “everywhere throughout the Universe he saw the glory and the greatness of God, and the science of Nature was particularly dear to him. Every new fact which came within his range was carefully weighed [...] so he felt a joy in her orderliness; he felt a rest in her steadfastness, patient progress and hopefulness.”¹⁰ The problem of natural theology during the first half of the nineteenth century, however, was that the image of God blurred and that his presence seemed ever more distant. Lyell’s *Principles* is a good example of this. Lyell, in the conclusion of the third volume, firmly places his work in the tradition of natural theology, but his creator is impersonal, abstract and remote. Although the scientists tried to separate science from religion for the sake of both, Tennyson, who read scientific works with a more emotional attitude than the purely scientific writing supported, feared an estranging process of rationality in the study of nature. As a result, he came to distrust natural theology. This criticism is implicit in the scientific sections of *In Memoriam*.

References to geological theory are rare in his early poems, although ideas of geological time are present, and fossils are repeatedly used as metaphors. Tennyson, no doubt, had an adequate schooling in the basics of geological theory, but he remained a minor figure in the geological scene. He was not a geologist of Charles Kingsley’s stature, who, though an amateur geologist, did much to advance the science. In his son’s memoir, in fact, geological names are remarkably scarce, whereas it abounds in descriptions of meetings with biologists like Darwin, Tyndall, and Huxley. The following extract from Mrs Rundle Charles’ diary describing Tennyson’s stay at her uncle’s house in Plymouth in 1848 is indicative of the influence of geological discovery on Tennyson’s imagination:

Then he turned to Geology, Weald of Kent, Delta of a great river flowing from as far as Newfoundland. “Conceive,” he said, “what an era of the world that must

⁹ *Memoir*, p.265.

¹⁰ *Memoir*, p.262.

have been, great lizards, marshes, gigantic ferns!" Fancied, standing by a railway at night, the engine must be like some great Ichthyosaurus. I replied how beautiful Hugh Miller's descriptions of that time are: he thought so too.¹¹

But such an approach to geology cannot by any means be called scientific. It confirms Chadwick's analysis of the poet's scientific approach, and this is something we have to keep in mind when tracing the sources of his geological concepts in his poems. The difficulty of identifying sources, moreover, might be attributed to the fact that there are no definite sources, but that they are a reflection of Tennyson's general reading on the subject. Thus catastrophist and uniformitarian principles might be found side by side, without any clear separation, critical exposition or personal commitment.

The attraction of geology lay in the poetic possibilities of the infinity of time (as paralleled in the vastness of space) and its testimony of a long series of extinct species. The vastness of space, which Tennyson worked out in *Maud* (1855), is stunning to the anthropocentric view of man:

the boundless plan
That made thou tyrants in your iron skies,
Innumerable, pitiless, passionless eyes,
Cold fires, yet with power to burn and brand
His nothingness into man.

There is something baleful in the redimensioning of man's concept of space and time. In 1839 Tennyson writes to his future wife, Emily Sellwood: "Annihilate within yourself these two dreams of Space and Time. To me often the far-off world seems nearer than the present, for in the present is always something unreal and indistinct, but the other seems a good solid planet, rolling round its green hills and paradises to the harmony of more steadfast laws."¹²

The process of geological change inspires awe not necessarily different from religious reverence for the infinity of God's plan, beside whose evanescent slow change man, with his short existence and limited understanding, must feel small indeed.

There rolls the deep where grew the tree.
O earth, what changes hast thou seen!
There where the long street roars hath been
The stillness of the central sea.

The hills are shadows, and they flow
From form to form, and nothing stands;
They melt like mist, the solid lands,
Like clouds they shape themselves and go.¹³

¹¹ *Memoir*, p.230.

¹² *Memoir*, p.144.

¹³ *In Memoriam* 35, 123.

Tennyson's observations of the "streams" are at the core of much of Lyell's principle of stability of the system. The eroding power of "swift" rivers and torrents is obvious to any observer, but even "the more tranquil rivers of the valleys and the plains [...] remove the prodigious burden which is discharged into them by their numerous tributaries, and [...] convey the whole mass to the sea." The process assures a constant interchange between the "dust of continents" and "the homeless" sea. That Tennyson was inspired by Lyell in this can be shown by the prominence of such ideas in Lyell's *Principles*. Lyell returns repeatedly and emphatically to the evidence that in the sea

the renovating as well as the destroying causes are unceasingly at work, the repair of land being as constant as its decay, and the deepening of seas keeping pace with the formation of shoals [...Thus the sea] extended over the greater part of the area now occupied by the lands which we inhabit [...] Down to the period, therefore, when the rocks [...] were deposited, there was sea where now the principal chain of Europe extends.¹⁴

Of course, one may read a disconcerting lack of solidity into the system of uniformity, and Tennyson undoubtedly did so. The stability of the system becomes "a maniac, scattering dust." Lyell's dynamics seem to argue for indifference of the system towards its components: although "so often the source of death and terror to the inhabitants of the globe [...it] is, nevertheless, a conservative principle in the highest degree, and, above all others, essential to the stability of the system."¹⁵ The system does not take care of the individual, it seems. How important is man then in the scheme of creation? Where does providence come in?

These questions were confusing to Tennyson. As early as "The Two Voices," written soon after the, to Tennyson, philosophically inexplicable death of Arthur Hallam, he tried to come to terms with the extinction of the individual as part of the economy of nature:

Tho' thou wert scatter'd to the wind,
Yet is there plenty of the kind.

Even in "The Two Voices" it is difficult to feel some comfort and consolation in the assertion of natural theology that although the individual dies the type survives. In *In Memoriam* Tennyson continues this train of thought, when he proposes the paradox of God and Nature again:

Are God and Nature then at strife,
That Nature lends such evil dreams?
So careful of the type she seems,
So careless of the single life.¹⁶

¹⁴ *Principles* i.473,133,137.

¹⁵ *Principles* i.479.

¹⁶ *In Memoriam* 55.

Natural theology had long tried to explain away God's carelessness of the single life in a manner which is not acceptable for Tennyson. Natural theology consoles itself that pain and death serve a greater goal, a position Tennyson reluctantly picks up—

Oh yet we trust that somehow good
Will be the final goal of ill,
To pangs of nature, sins of will,
Defects of doubt, and taints of blood;

That nothing walks with aimless feet;
That not one life shall be destroy'd,
Or cast as rubbish to the void,
When God hath made the pile complete;

That not a worm is cloven in vain;
That not a moth with vain desire
Is shrivell'd in a fruitless fire,
Or but subserves another's gain.

—and then discards:

“So careful of the type?” but no.
From scarpéd cliff and quarried stone
She cries, “A thousand types are gone;
I care for nothing, all shall go.”¹⁷

Principles might have contributed to Tennyson's difficulties with the “Power, Wisdom, and Goodness of God” as epitomized by the Paleyan school of thinkers. Lyell's God, although granted these attributes, remains frighteningly distant and impersonal. Lyell affirms “the clear proofs of a Creative Intelligence, and of His foresight, wisdom, and power,”¹⁸ but the probably arbitrary absence of “goodness” in Lyell's plan is indicative of much of the tone of *Principles*. To a reader like Tennyson it would have affirmed that the progress of science made the dispensation of God and the reality of providence ever more doubtful.

Arthur Hallam's death seemed to disclose not only nature's indifference but also the frightening prospect that there is no entity whatsoever to care for man's existence (“I care for nothing”), and that the death of the individual is not principally different from the “thousand types gone” in a system which is essentially “red in tooth and claw.”

In later life Tennyson wrote that “an omnipotent Creator who could make such a painful world is to me sometimes as hard to believe in as blind matter behind everything. The lavish profusion too in the natural world appals me, from the growths of the tropical forest to the capacity of man to multiply, the torrent of babies.”¹⁹ Natural theology saw the existence of destruction and the

¹⁷ *In Memoriam* 56.

¹⁸ *Principles* iii.384.

¹⁹ Hough, “The Natural Theology of *In Memoriam*,” p. 247.

profusion of life closely interlinked.²⁰ Paley recognized that “the system of destruction amongst animals holds an express relation to the system of fecundity.”²¹ The argument is central in Lyell’s second volume of *Principles* where his vivid descriptions of insect fecundity might well have suggested Tennyson’s use of insects in a section of *In Memoriam*. Compare:

A scanty number of minute individuals, only to be detected by careful research, are ready in a few days, weeks, or months, to give birth to myriads [...] The gigantic power [then again] becomes dormant—each of the mighty host soon reaches the term of its transient existence, and the season arrives when the whole species passes naturally into the egg.²²

Be near me when my faith is dry,
And men the flies of latter spring,
That lay their eggs, and sting and sing
And weave their pretty cells and die.²³

Both passages emphasize the petty span of life when set off against the eternal process of nature.

Lyell dwells at length on the fecundity of nature, and through massive evidence reaches the conclusion that the excessive promulgation of life is essential for the stability of the system to counterbalance death:

Every species which has spread itself from a small point over a wide area, must, in like manner, have marked its progress by the diminution, or entire extirpation, of some other, and must maintain its ground by a successful struggle against the encroachments of other plants and animals [...] In the struggle for existence, the right of the strongest eventually prevails; and the strength and durability of a race depends mainly on its prolificness.²⁴

The final movement of *In Memoriam* renounces the limited interpretations of natural theology as inadequate:

I found Him not in world or sun,
Or eagle’s wing, or insect’s eye,

A warmth within the breast would melt
The freezing reason’s colder part,
And like a man in wrath the heart
Stood up and answered, “I have felt.”²⁵

Tennyson’s interpretation of Lyell’s geology expresses the perplexity of the Victorian intellectual when confronted with traditional faith. Lyell, in many senses the logical and ultimate outcome of natural theology, had reduced the

²⁰ Hough, “The Natural Theology of *In Memoriam*,” p. 248.

²¹ *Natural Theology*, p.316.

²² *Principles* ii.134.

²³ *In Memoriam* 50.

²⁴ *Principles* ii.156, 56.

²⁵ *In Memoriam* 123.

active role of the Creator so much as to lose sight of him behind an enormous plan of nature, bewilderingly complex in its interrelationships, stunning in its limitless time.

Lyell in 1856 jots down that, although the facts of science might not square with received notions of the benevolence of God, yet "there is only one great resource to fall back upon, a reliance that all is for the best, trust in God, a belief that truth is the highest aim."²⁶ Tennyson finds a similar peace of mind in 1892:

"Yet God *is* love, transcendent, all-pervading! We do not get *this* faith from Nature or the world. If we look at Nature alone, full of perfection and imperfection, she tells us that God is disease, murder and rapine. We get this faith from ourselves, from what is highest within us, which recognizes that there is not one fruitless pang, just as there is not one lost good."²⁷

Elizabeth Barrett Browning would have agreed with such a conclusion. In *Aurora Leigh* (1856), the poem she described as "intensely modern, crammed from the times,"²⁸ she emphasizes that, although the highest expression of love is God's love, nineteenth-century man had been led to look for God's attributes solely in the perfection of the laws of nature:

God Himself, with some,
Is apprehended as the bare result
Of what His hand materially has made.²⁹

The progress of the geological science became for Barrett Browning symbolical of the tendency in modern science to alienate man from his creation and his fellow men, by making him feel insignificant in the plan of nature. While science tends to make man "impatient that we're nothing," it is through love, "the soul of soul," that man can approach his creator:

Good love, howe'er ill-placed,
Is better for a man's soul in the end,
Than if he loved ill what deserves love well.
A pagan, kissing for a step of Pan
The wild goat's hoof-print on the loamy down,
Exceeds our modern thinker who turns back
The strata . . . granite, limestone, coal, and clay,
Concluding coldly with, "Here's law! where's God?"³⁰

Not unlike Tennyson's, Barrett Browning's world view remains basically anthropocentric:

Six days' work;
The last day shutting 'twixt its dawn and eve

²⁶ *Scientific Journals*, p.121.

²⁷ *Memoir*, p.263.

²⁸ *Letters of Elizabeth Barrett Browning to Mary Russell Mitford* iii.49.

²⁹ *Aurora Leigh* viii.636-638.

³⁰ *Aurora Leigh* v.1112-1119.

The whole work bettered of the previous five!
Since God collected and resumed in man
The firmaments, the strata, and the lights,
Fish, fowl, and beast, and insect—all their trains
Of various life caught back upon His arm,
Reorganised, and constituted MAN,
The microcosm, the adding up of works—
Within whose fluttering nostrils, then at last
Consummating Himself the Maker sighed,
As some strong winner at the foot-race sighs,
Touching the goal.³¹

³¹ *Aurora Leigh* vi.149-161.

CHAPTER THIRTEEN

DEUS QUIDAM DECEPTOR

In Edmund Gosse's autobiographical novel *Father and Son* (1907) the author records his father's pre-Darwinian reaction to geological time, which is one of the most curious writings in the Moses-geology debate. On the eve of the disclosure of evolutionary theory, his father, the distinguished zoologist Philip Henry Gosse, felt the urge to write a book in defence of the literal meaning of the Scriptures. By the year 1857, when the volume *Omphalos* came out, Gosse had already earned a reputation as a popularizer of science, and was probably at the height of his literary fame. His books are characterized by original scientific observation as well as by his great capacity of recording picturesque detail. He cleverly mixes scientific research with trivial talk and manages to give a romantic glow to his pursuits. Most of his works are illustrated with colourful drawings made by the author himself. He was thus able to raise the enthusiasm of the general reading public. His invention of the marine aquarium, for example, created a rage in the fashionable circles for years, to such an extent that much of the Devon seashore was devastated by hobbyists chiselling away on rocks rich with sea-anemones.

Gosse became a Wesleyan early in life and in 1839 applied to the Methodist Conference to become a travelling preacher. In 1847 he abandoned Wesleyanism for the Plymouth Brethren. These "brethren" met regularly in earnest faith to worship and to study the Bible. The members were well-educated and "almost all could refer to the Greek original."¹ Ritual on Sunday was limited to adult baptism and the weekly "breaking of the bread"—the passing of a loaf of bread and a cup of wine from which all the baptised members of the congregation partook in silence. There was no religious institution or appointed minister and their creed was entirely Scripture-based. The austerity of the members is well-known from *Father and Son*. Although the practices of the Plymouth Brethren suited Gosse's religious outlook well, he spent the last thirty years or so without forming any religious connections with established churches or sects. He continued preaching to a congregation of friends at St. Mary's (Torquay) called "The Church of Christ in this Parish," where the infallibility of God's Word remained central and undisputed.

Gosse never looked upon his scientific researches as revelatory in a

¹ *The Life of Philip Henry Gosse*, p.378.

religious sense. He was not a systematic philosopher, and the results of his researches needed a greater mind to make them bear on issues such as those which started to emerge in the field of evolution. Gosse studied nature for its own sake. In religious matters he was steadfastly led by his convictions, which he summed up in 1878 as follows:

The whole of my theology rests on, and centres in, the Resurrection of Christ. That Jesus was raised from the dead, is an historical fact, the evidence for which is, in my judgment, impregnable. I ask no more than this; everything else follows inevitably.²

His mind was not that of a doubter, and his belief rested firmly in revelation. Although he collaborated often with Darwin, before and after the publication of *The Origin of Species*, evolutionary theory never disturbed him. Strangely enough, however, he did mind the geologists' lengthening of the creation, which was an unwarranted refutation of the Mosaic account; in 1857 this led him to write *Omphalos, An Attempt to Untie the Geological Knot*.

What made Gosse suddenly turn his pen to geology remains rather obscure. He was a zoologist with a minimal knowledge of geology. In 1839 he had refused the curatorship of a museum, because, amongst other reasons, he said he was "totally ignorant of mineralogy"³ and in his son's biography there is no evidence of geological research. Of course, he did acquaint himself with the more popular publications in the field, but grossly ignored Lyell in his book. His son writes in 1907:

My Father had never admired Sir Charles Lyell. I think that the famous "Lord Chancellor manner" of the geologist intimidated him [...] and I know not whether this had anything to do with the fact that he chose, for his impetuous experiment in reaction, the field of geology, rather than that of zoology or botany. Lyell had been threatening to publish a book on the geological history of Man, which was to be a bomb-shell flung into the camp of the catastrophists. My Father, after long reflection, prepared a theory of his own, which, as he fondly hoped, would take the wind out of Lyell's sails, and justify geology to godly readers of "Genesis."⁴

His son's account in this and the other pages of *Father and Son* which describe the genesis of *Omphalos* emphasizes the belligerent character of the father. Gosse, however, does not want to appear antagonistic to the geologists, but would rather be seen "as a co-searcher with them after that which they value as highly as I do, TRUTH."⁵ However artificial and evasive the book might have seemed to more enlightened readers, it was nevertheless a sincere

² *Life of P. Gosse*, p.325.

³ To Mr. William Clarke, April 25, 1839, *Life of P. Gosse*, 152.

⁴ *Father and Son*, p.76. Although Gosse does not mention Lyell anywhere in his book, its subtitle might well refer to him, as Lyell had explicitly compared geological research to untying the Gordian knot, (*Principles* iii.6).

⁵ *Omphalos*, p.vii.

expression of his conscientious mind. He shared with the Plymouth Brethren the belief that man should submit to injury and affront and leave reprisal to God. During his life he was robbed twice, and on both occasions he refused to prosecute, once when a constable had actually brought the culprit to his face.⁶ To read irony in his reference to geological theory in *Omphalos* would therefore be to misread the book. He firmly believed in the contribution his book would give to the science. On the other hand, he would not shirk from criticism when he thought it was right to speak out for the literal truth of the Scriptures: “the path which I have pursued has led me to a conclusion at variance with theirs [the geologists’]. I have a right to expect that it be weighed; let it not be imputed to vanity if I hope that it may be accepted.”⁷ Unfortunately, the book turned out to be his literary undoing, which lost him both esteem in scientific circles and popularity with the general reading public. The professional geologists could only feel contempt for it; the public, kindled by Chambers’s *Vestiges*, felt impatient with this attempt to set the geological clock back to the Mosaic time.

Gosse felt he could write a book on geology, notwithstanding his lack in geological grounding, because his approach lay in observations of the botanist and zoologist applied to the Mosaic account of the creation. Indeed, he admits that he is not going to fight geological finds, as the calculations of the geologists “are sound on the recognized premises.” But, he continues, “*they have not allowed for the Law of Prochronism in Creation.*”⁸

The author opens his discussion with the observation that the evidence of the senses is often delusive and the deductions of reason fallible. A certain amount of caution is therefore necessary when we start judging events which happened in remote antiquity and which seem to contradict “credible historic testimony.”

Especially as there is many a scientist “to whom the veracity of God is as dear as life [but who] cannot shut their eyes to the startling fact, that the records which *seem* legibly written on His created works do flatly contradict the statements which *seem* to be plainly expressed in His word,”⁹ Gosse feels called upon to do what men like Buckland, Sedgwick, Chalmers and Conybeare had nobly, but unsuccessfully, tried before him: to untie the geological knot. He emphatically excludes discussion with “those good men who *merely* denounce Geology and geologists,” as well as, of course, with those who make “scientific deduction paramount, and make the Word go to the wall.”¹⁰ He proposes a fair trial where witnesses of both sides will be patiently heard before any final

⁶ *Life of P. Gosse*, p.214.

⁷ *Omphalos*, p.vii.

⁸ *Omphalos*, p.vi.

⁹ *Omphalos*, p.5.

¹⁰ *Omphalos*, p.8.

conclusion is drawn. He thus presents his argument at a session of a high court of inquiry.

The witness for the veracity of the Mosaic account of the creation is the circular nature of all life on earth. It is impossible, Gosse argues, to point at any stage in the existence of an individual as its beginning. "There is no such point; no stage which does not look back to a previous stage."¹¹ Thus the moth was previously a pupa, larva and egg, which again came from a moth; the cow, a heifer, calf, foetus, embryo, embryonic vesicle, germinal vesicle, and initially an ovum which

was, before it assumed a distinct individuality, an undistinguishable constituent of a viscus,—the ovary,—of another cow, an essential part of *her* structure, a portion of the tissues of *her* body, to be traced back, therefore, through all the stages which I have enumerated above, to the tissues of another parent cow, thence to those of a former, and so on, through a vista of receding cows, as long as you choose to follow it.¹²

One of the postulates in the hearing is the creation of matter. So there must have been a beginning. Adam, though he was the first man, bore the cicatrice where once the umbilical cord was attached, yet was never born of woman. Factual observation is, therefore, clearly fallible to Gosse. The *omphalos* is evidence of a past time which never existed, viz. prochronic time. All created life, at the moment of creation, shows signs of a prochronic past, signs of an endless circle of existence in the past. The deduction of this kind of evidence of past time is based on effects which never had causes. "Creation is a violent irruption into the circle of nature."¹³

The gist of the argument is clear. Could not God have created the surface of the earth likewise, with fossil plants and animals belonging to prochronic development? As God must have created a perfect world, he could not have left out those vestiges which imply past development without making his creation less perfect. As another postulate to the argument is that species are immutable, plants and animals cannot exist free of these retrospective marks without losing many characteristics which "preserve their specific identity with those with which we are familiar."¹⁴ Prochronic development shows that geological evidence is ideal rather than real, and, more important, that it leaves the Mosaic account of the creation unimpaired. Gosse, therefore, finishes by sending the witness of uniformitarianism out of court, to leave the field "clear and undisputed for the one Witness on the opposite side, whose testimony is as follows:—'in six days Jehovah made Heaven and Earth, the sea, and all that in them is.'"¹⁵

¹¹ *Omphalos*, p.116.

¹² *Omphalos*, pp.121-22.

¹³ *Omphalos*, p.126.

¹⁴ *Omphalos*, p.349.

¹⁵ *Omphalos*, p.372; the testimony is printed in capital letters in the original.

Gosse expected much from his theory, but the book was rejected with scorn everywhere. Its solution to geological time as opposed to the Bible was too childish to be accepted after the geological progress of a quarter of a century. It demolished the very foundations of scientific enquiry. Unfortunately the book was only ridiculed as advocating that God had hidden fossils in the rocks in order to deceive honest scientists, while nobody seemed to see in this book the sure sign that Genesis and science had grown so wide apart as never to allow of reconciliation again. In its inadequacy the book, contrary to Gosse's intention, pointed to the need of society for a new theory of the creation. It appeared two years later in 1859 in *The Origin of Species*, in which Darwin stretched geological time so much as to astound even Lyell.

When *Omphalos* was received with scorn by the public and was ignored by the professional geologists, Gosse appealed to his friend Charles Kingsley. Kingsley had earned himself quite a reputation as clergyman-novelist-naturalist and was well-known for his religious fervour. However, he responded to Gosse's theory in such a way as to leave no doubt about his ideas on science and religion; he could not "give up the painful and slow conclusion of five and twenty years' study of geology, and believe that God has written on the rocks one enormous and superfluous lie."¹⁶ He repeatedly asked his readers to use their common sense and not to believe in a *Deus quidam deceptor* "who puts shells upon mountain-sides only to befool honest human beings."¹⁷ Gosse's thesis ran counter to Kingsley's ideal of God's honesty.

Unlike Gosse, Kingsley was a keen amateur geologist whose role in geology was not that of an original contributor. Nevertheless, he was made a fellow of the Geological Society in 1863, upon the proposal of Charles Bunbury,¹⁸ seconded by Lyell. His is the work of a fervent amateur scientist who sided decidedly with the scientists but never doubted God's hand in the creation. "You must not confound Madam How and Lady Why. Many people do it, and fall into great mistakes thereby," Kingsley writes in his "lessons in earth lore for children."¹⁹ He is one of those few clergymen-geologists who accepted the conclusions of science but whose faith could not diminish the grandeur of the Creator. He welcomed Darwin's *Origin of Species* without reserve. His writings, therefore did not eschew either science or religion:

He had the unhappiest knack (as all geniuses have) of seeing connexions [...] If

¹⁶ *Father and Son*, p.77.

¹⁷ *Town Geology*, pp.64-65.

¹⁸ In 1844 Charles Bunbury had married Frances Joanna Horner, Lyell's sister-in-law. He had met Kingsley in the late 1850s, and noted in a private journal the impression Kingsley made on him: "Every fresh opportunity of cultivating his society, adds to my regard and admiration for him; and I flatter myself that the liking is reciprocal. I have seldom met with a finer or more cultivated mind: at once refined and vigorous." (*Diaries and Correspondence of Sir Charles James Fox Bunbury*, ii.163). Lyell probably met Kingsley every now and then at the Bunbury household (*ibid.* ii.245).

¹⁹ *Madam How and Lady Why*, p.3.

he wrote a physical-science article, able editors asked him what the deuce a scrap of high-churchism did in the middle of it? If he took the same article to a high-church magazine, the editor could not commit himself to any theory which made the earth more than six thousand years old.²⁰

Richard Cowley Powles, a former school friend, recalls how Kingsley as a sixteen-year-old schoolboy had a passion for geology: “He liked nothing better than to sally out, hammer in hand and his botanical tin slung round his neck.” Powles adds that Kingsley’s boyhood interest in natural science was “led by a strong religious feeling—a sense of the nearness of God in His works.”²¹ As in many biographical accounts of childhood given in retrospect, this conclusion might be coloured by the subject’s views of nature in later life. A few years later, however, Kingsley was to recommend the study of nature in a letter to his future wife in the following terms:

Study nature—not scientifically—that would take eternity, to do it so as to reap much moral good from it. Superficial physical science is the devil’s spade, with which he loosens the roots of the trees prepared for the burning. Do not study matter for its own sake, but as the countenance of God. Try to extract every line of beauty, every association, every moral reflection, every inexpressible feeling from it. Study the forms and colours of leaves and flowers, and the growth and habits of plants; do not classify them, but to admire them and adore God. Study the sky. Study water. study trees. Study the sounds and scents of nature [...] Read geology—and you will rise up awe-struck and cling to God.²²

His wife affirmed that “from boyhood geology had been his favourite study; but since he entered the Church it had assumed a still deeper importance from the light he believed it might throw on Bible history.”²³ This, in fact, is his thesis in his popular works on science.

In a letter to the Chartist poet Thomas Cooper, Kingsley himself claimed that the study of nature had helped to form his theological outlook and made him “believe more and more utterly, that the peculiar doctrines of Christianity (as they are in the Bible, not as some preachers represent them from the pulpit) coincide with the loftiest and severest Science.”²⁴ Kingsley’s natural theology was not a blind one, however, and did raise doubts “about God’s absolute righteousness [...] in a universe in which everything is eternally *eating* everything else.” But when he asks himself whether God is a “‘Deus quidam Deceptor,’ after all” the answer is an unequivocal “no” because

there is something in me—which not my nature, but Thou must have taught me—which cries and will cry: Though Thou slay me, as Thou hast slain world on world

²⁰ *Yeast: A Problem*, p.233.

²¹ *Charles Kingsley: His Letters and Memories of His Life*, p.8.

²² August 1842, *Letters and Memories*, pp.32-33.

²³ *Letters and Memories*, p.249.

²⁴ Undated 1854, *Letters and Memories*, p.148.

already—though I and all this glorious race of men go down to Hades with the ichthyosaurs and the mammoths, yet will I trust in Thee.

To Frederick Denison Maurice he wrote that such a moral truth, once recognized, could not be affected by any scientific discovery, although the study of nature unteach it “if the roots of moral theology be not already healthy and deep in the mind. I hinted that in ‘Glaucus’: but I would do no more, because many readers mean by ‘moral’ and ‘theology’ something quite different from what you and I do, and would have interpreted it into a mere iteration of the old lie that science is dangerous to orthodoxy.”²⁵

Glaucus (1855) does indeed contain the key to Kingsley’s views on the relationship between geology and religion and explains why he was not willing to side with Gosse to defend revelation against geology. The book is an expression of the delight found in natural studies and the moral benefit that can be drawn from such studies. The didactic end is often referred to, and Kingsley advocates the study of nature as one of the best, though not the only, preparation for life. Natural history helps to form man’s moral character by accustoming him to contemplate and ingratiate himself with nature’s

inexhaustible fertility and variety, which will keep him his life long always reverent, yet never superstitious; wondering at the commonest, but not surprised by the most strange; free from the idols of size and sensuous loveliness; able to see grandeur in the minutest objects, beauty in the most ungainly; estimating each thing not carnally, as the vulgar do, by its size or its pleasantness to the senses, but spiritually, by the amount of Divine thought revealed therein.²⁶

The Divine Spirit can best be studied in Nature, as even the minutest things reflect the “amount of Divine thought revealed to him therein.” That Kingsley is close to a Paleyan interpretation of nature cannot be doubted. The enormous variety of animal and vegetable life—“a waste of power, on any utilitarian theory of nature!”—cannot but be the “design of some personal will and mind,” created “for no conceivable reason save her [nature’s]—shall we not say honestly His?—own good pleasure.”²⁷ It is worth noting how easily Kingsley flows from advice for naturalists to prescribing how to lead the life of a good Christian. To Kingsley the study of nature and the study of religion are closely interwoven.

Although *Glaucus* is a popular presentation of marine zoology, references to geology abound. In a telling passage Kingsley argues that the pursuit of geology is perfectly in harmony with religious awareness of the greatness of God’s creation, and the geologists ought to be praised rather than blamed for their discoveries. It deserves quotation in full:

²⁵ Letter to F.D. Maurice, undated 1856, *Letters and Memories*, pp.181-182.

²⁶ *Glaucus; or, The Wonders of the Shore*, pp.44-5.

²⁷ *Glaucus*, pp.45,132,112.

it is a question whether Natural History would have ever attained its present honours, had not Geology arisen, to connect every other branch of Natural History with problems as vast and awful as they are captivating to the imagination. [... Lyell and the] brave men who accompanied and followed [him], will be looked back to as moral benefactors of their race; and almost as martyrs, also, when it is remembered how much misunderstanding, obloquy, and plausible folly they had to endure from well-meaning fanatics [...] and the respectable mob at their heels who tried (as is the fashion in such cases) to make a hollow compromise between fact and the Bible, by twisting facts just enough to make them fit the fancied meaning of the Bible, and the Bible just enough to make it fit the fancied meaning of the facts. But [...] sound practical geologists [...] have wielded in defense of Christianity the very science which was faithlessly and cowardly expected to subvert it.²⁸

The immensity of geological time is to Kingsley another argument in favour of the infinity of God, but his personality is never lost from view. Kingsley did not suffer from Tennyson's anxiety about a distant and impersonal god: "through all the abysses and the ages" man can always see "a living countenance, human and yet Divine."²⁹ It is true that the age of the earth "beside which the mortal life of man is as the life of the gnat which dances in the sun" is "a length of time which has been well called 'appalling' [...]—it is very astonishing, appalling—all but incredible, if we had not the facts to prove it."³⁰ But if well considered, the immensity of time is proof of the perfection of the creation. Kingsley wants the reader to infer from geological time that the longer God has had time to refine the world the more perfect it will be. Time is just another of God's wonders although man cannot pretend to grasp it fully: "[to create the earth] God has employed ages and ages, further back than wisdom can guess or imagination picture."³¹ Thus in the end time appealed to Kingsley's religious sentiment as it did to Lyell's: "[change] was probably gradual. Not by spasmodic leaps and starts, but slowly and stately, as befits a God of order, of patience, and of strength, have these great deeds been done."³²

Kingsley was an advocate of introducing geology to the general public and he felt none of the reserve which Whewell or Newman recommended in publicizing controversial discoveries before they were firmly established. Geology needed a more important place in educational programmes, as people's comfort, wealth and health depend so much on the constitution of the planet they live on. Moreover, Kingsley has a rather romantic view of natural science as the only truly democratic science: "And I tell you—that in becoming scientific men, in studying science and acquiring the scientific habit of mind, you will find yourselves enjoying a freedom, an equality, a brotherhood, such

²⁸ *Glaucus*, pp.11-14.

²⁹ *Glaucus*, p.125.

³⁰ *Town Geology*, pp.116,65,69.

³¹ *Glaucus*, p.3.

³² *Town Geology*, p.111,

as you will not find elsewhere just now.” Real freedom, to Kingsley, is “that we may be each and all able to think what we choose,” and not merely pick up opinions at second hand. It is science alone that can teach man the right freedom of mind, “the art of connecting facts together in your own mind in chains of cause and effect, and that accurately, patiently, calmly, without prejudice, vanity, or temper.” As far as equality is concerned, natural science is the poor man’s science. The rich have “neglected it hitherto [...] so that they have not the start of the poor man;” moreover, it will not do to pay teachers, the student must teach himself by patient observation. As for books, “a poor man now can obtain better scientific books than a duke [...] could sixty years ago, simply because then the books did not exist;” more expensive books or equipment should be bought in co-operative natural science clubs. Brotherhood, finally, is attained by mixing “with men, and men, too, eminently worth mixing with.”³³

In terms of religion too natural science is a suitable field of study for the believer. It is not antagonistic to religion in the least. The study of nature is not secular and is a suitable pursuit for the clergy: “I grudge that epithet of secular to any matter whatsoever [...] To those who believe in God, and try to see all things in God, the most minute natural phenomenon cannot be secular.” The laws of nature are but the laws of God, so that “the more you know of physical science, the more you will know of the works and of the will of God.” Consequently, “we shall not fear to investigate Life; for we shall know, however strange or novel, beautiful or awful, the discoveries we may make may be, we are only following the Word whithersoever He may lead us; and that He can never lead us amiss.” The emphasis falls expressly on studying the earth as a product of God’s mind; Kingsley does not concern himself with origins, but only with what the earth is made of. As a result God, notwithstanding regular reminders of the existence of the Creator, is as strikingly absent in *Glaucus* as in Lyell’s *Principles*. The protagonist is at all times the earth itself and its epic history. Thus Kingsley asks rhetorically in *Town Geology*: “Have we not wandered on, step by step, into a whole true fairy-land of wonders?” And he explains: “I have turned over for you a few grand and strange pages in the book of nature, and taught you, I hope, a key by which to decipher their hieroglyphics.”³⁴ The descriptions of prehistoric creatures are on the scale of Spenser’s monsters in *The Faerie Queene*, Kingsley’s favourite poem:

Looking at his hands and other remains, one pictures him to oneself as a short, squat brute, a big a fat hog, with a head very much the shape of a baboon, very large hands behind and small ones in front, waddling about on the tide flats of a sandy sea, and dragging after him, seemingly, a short tail, which has left its mark on the sand.³⁵

³³ *Town Geology*, pp. xvi, xxviii, xxviii, xxxii, xxxiv, xxxv-xxxvi.

³⁴ *Town Geology*, pp. xlv-xlvi, xlvii-xlviii, lvi, 79.

³⁵ *Town Geology*, p. 93.

He presents geology as “an epos of the destruction and re-creation of a former world,” an emblem of the “antiquity, the grandeur, the true poetry.”³⁶ In a poem-invitation addressed to his friend Tom Hughes he urges to

See in every hedge-row
Marks of angel's feet,
Epics in each pebble
Underneath our feet.³⁷

Thus on various occasions Kingsley stresses the poetic quality of the history of nature and affirms that to study natural history is far better than an “interminable reading of the silliest of novels, over which you fall asleep on a bench in the sun.”³⁸ In his own novels, however, he ignores the artistic possibilities he so often highlighted in his non-fiction. And even where geology is introduced, his use of it remains peripheral. In *Two Years Ago* (1857), for example, geological fact abounds, but it never rises above mere descriptive use.

A Victorian fear of the infinite, however, can be traced in *Alton Locke* (1850): Alton at a moment of religious crisis dreams about the place of man in the creation and tries to come to terms with the concept of space. The piece is extraordinary pre-Darwinian development theory but is not expressly linked to geology or its new dimension of time. The search for an identity in an infinite universe had already been explored by Kingsley in his early poem “Hypotheses Hypochondriacae” (1835) which reveals an oppressive sense of enormity in the vastness of time and space:

visions, crude and dire,
Of planets, suns, millions of miles, infinity,
Space, time, thought, being, blank nonentity,
[...] tall mountains
Cleaving the skies with height immeasurable,
On which perchance I climb for infinite years; broad seas,
Studded with islands numberless, that stretch
Beyond the regions of the sun, and fade
Away in distance vast, or dreary clouds,
Cold, dark, and watery, where I wander for ever!

“There is in men, and there remains in them, even after they are civilised, and all other forms of the dread of Nature have died out in them, a dread of size, of vast space, of vast time,” Kingsley writes in an essay in 1867.³⁹ Such is the case in Kingsley's first novel *Yeast* (1848). A feeling of smallness linked to religious apathy is part of the development of Lancelot Smith's mind and

³⁶ *Glaucus*, p.26; *Town Geology*, p.238.

³⁷ “The Invitation” (1856).

³⁸ *Glaucus*, p.2.

³⁹ “Science” in *Scientific Lectures and Essays*, p.243.

religion. Early on in the novel, when Smith is introduced to the reader during a fox-hunt while he is waiting listlessly for the fox to break from cover, Kingsley casually remarks that his protagonist is thinking of his half-finished review of the Silurian System. This marks him out as an expert in geology, as Murchison's *Silurian System* (1839) was not a popular treatise but a technical study of some specific formations. Cheerless reflection and "a saddened tone of feeling" [then] spread itself through Lancelot's heart":

There were the everlasting hills around, even as they had grown and grown for countless ages, beneath the still depths of the primeval chalk ocean, in the milky youth of this great English land. And here was he, the insect of a day, fox-hunting upon *them*! He felt ashamed, and more ashamed when the inner voice whispered,—“Fox-hunting is not the shame—thou art the shame. If thou art the insect of a day, it is thy sin that thou art one.”⁴⁰

This sense of smallness is not alleviated by religion because religion is not tangible enough to Smith. When, in a discussion with the High-Church character Argemone, he is asked what he believes in, he answers:

“In *this*!” he said, stamping his foot on the ground. “In the earth I stand on, and the things I see walking and growing on it. There may be something beside it—what you call a spiritual world. But if he who made me intended me to think of spirit first, He would have let me see it first. But as He has given me material senses, and put me in a material world, I take it as a fair hint that I am meant to use those senses first, whatever may come after. I may be intended to understand the unseen world, but if so, it must be, as I suspect, by understanding the visible one; and there are enough wonders there to occupy me for some time to come.”⁴¹

Not the Bible but Bacon, Lancelot rationalizes: “if that Hebrew Bible is to be believed by me, it must agree with what I know already from science.” But in the end Lancelot's exclusive study of nature results in a state in which he “hear[s] nothing in her but the grinding of the iron wheels of mechanical necessity.”⁴² At the end of the novel, however, when Smith demands proof of God's existence, geology becomes a foil to religion and he is urged as follows:

You took for granted what you read in geological books and went to the mine and quarry afterwards, to verify it in practice [...] Then go now, and do likewise. Believe that the learned, wise, and good, for 1800 years, may possibly have found out somewhat, or have been taught somewhat.⁴³

Seeing the harmony between man and his dwelling place will lead him into the living temple of Christendom.

⁴⁰ *Yeast*, p.13.

⁴¹ *Yeast*, p.148.

⁴² *Yeast*, p.295.

⁴³ *Yeast*, pp.307-8.

CHAPTER FOURTEEN
TOWARDS ABATEMENT OF THE FEVER

The dehumanizing power of geology

If a first generation of Victorian novelists did not see in geology a major threat of infidelity, a later generation of writers such as Samuel Butler and George Gissing explored the implications of scientific discovery on the religious mind and often lamented a loss of faith. Writers such as William Hale White (Mark Rutherford), George Eliot and Winwood Reade, on the other hand, saw the revelations of geology as a necessary prelude to a religion of humanity.

Samuel Butler, in setting the first part of *The Way of All Flesh* (1903) in the 1830s, describes geology as directly responsible for disbelief. His description is historical with little subtlety and sympathy for the suffering churchmen and incriminates an entire generation of clergymen:

In those days people believed with a simple downrightness which I do not observe among educated men and women now. It had never so much as crossed Theobald's mind to doubt the literal accuracy of any syllable in the Bible. He had never seen any book in which this was disputed, nor met with anyone who doubted it. True there was just a little scare about geology, but there was nothing in it. If it was said that God made the world in six days, why He did make it in six days, neither in more nor less.¹

Theobald, in what to Butler was clear proof of his narrowness of mind, joined the chorus of Mosaic geologists all the same:

He showed that so far as geology was worth anything at all—and he was too liberal entirely to pooh-pooh it—it confirmed the absolutely historical character of the Mosaic account of the Creation given in Genesis.²

Geology, by disproving the literalness of the Bible, contributed to Butler's thesis which showed the essential emptiness and fraud of Christianity. The reactions of churchmen to counter the tendencies of geology, therefore, are seen as part of that hypocrisy which runs all through Ernest Pontifex's evangelicalism. The influence of geology on the religious sentiments of the time is not worked out in greater detail and is replaced in Pontifex's later life by the problems raised by Darwinism.

¹ *The Way of All Flesh*, p.52.

² *The Way of All Flesh*, p.42.

In the months before starting on *Born in Exile* (1892) George Gissing was reading Lyell's *Elements of Geology* and Miller's *Testimony of the Rocks*. Much of the novel in fact centres on geological discovery and its influence on religious sentiment in English society. Although the novel is set in the 1870s and 1880s, geology was still a major influence on the way people saw nature and religion. In the novel a pre-Darwinian generation of geologists is contrasted with a new atheistic generation which uses geology as one of the great reasoning forces against orthodox religion.

Religion in terms of natural theology had become obsolete—so much so that the main character, Godwin Peak, lashes out at

treatises which pretend to reconcile revelation and science. It's quite pathetic to watch the enthusiasm with which they hail any man who distinguishes himself by this kind of apologetic skill, this pious jugglery.³

He respects men like Lyell “who were able to develop a new convolution in their brains” but the Mosaicists are to him “an obscene herd of idiot mockers.”⁴ His ridicule of these geologists is developed in an article he sets out to write and which is published as “The New Sophistry.” What Peak fails to realize is that this launches him into spiritual emptiness. It is this article that will lead to the destruction of Peak's ambitious plans.

Peak's mental growth can be measured against the geological knowledge he acquires. He is a joint winner of the academic reward for the geological essay with Buckland Warricombe. Peak's early acquaintance with Mr Gunnery—an apt name for the character who triggers off Peak's atheism—a man who “certainly never attended either church or chapel, and who seemed to have imbued his pupil with immoral theories concerning the date of creation”⁵—leads him to reject revelation. Gissing brings out the difference between Peak's generation and an older generation of amateur geologists of the still orthodox pre-Darwinian epoch. Of Buckland's father, for example, he writes that his “attainments [in geology] were respectable but what could be said of a man who had devoted his life to geology, and still (in the year 1884) remained an orthodox member of the Church of England?”⁶ Even Buckland informs Peak that his father “can't get rid of that old man of the sea, the Book of Genesis.”⁷

With the acknowledgement of the fallibility of the Bible in the face of geological discovery, religion becomes a cold calculating scheme for economical advance. The contrast between Mr Warricombe and the young generation brings a melancholy loss of humanity with it. The honest struggle of pre-Darwinian clergymen-geologists with the age of the earth forces Mr

³ *Born in Exile*, p.118.

⁴ *Born in Exile*, p.119.

⁵ *Born in Exile*, p.38.

⁶ *Born in Exile*, p.169.

⁷ *Born in Exile*, p.151.

Warricombe to conclude that "religious faith has rarely any connection with reasoning."⁸ When he sees a younger generation more sceptical of this approach to science and religion "a troublesome persistency of speculations which he would have preferred to dismiss altogether" sets in.⁹ His relapse to unquestioning orthodoxy comes with the death of a son which terminates forever the joy he had formerly found in geological speculation.

Gissing's sympathy is not entirely with the older generation. Mrs Warricombe is presented as a staunch emotive Anglican, "hopelessly illogical and at heart indifferent to everything but the small graces and substantial comforts of provincial existence." She had read Hugh Miller and William Buckland's works on geology, but would not sympathize with the problems which troubled her husband; she "held to a secret conviction that it was safer to belief in Genesis."¹⁰ Her relationship with other human beings is perhaps just as sterile as her son's or Peak's.

To Peak the contemplation of geological time has a numbing effect and makes man's emotions insignificantly small. As this concept of geological time is introduced at the beginning and towards the end of the novel, it works as a framework to the psychological development of its characters. At the beginning, when, during a walk, Peak works himself up to his decision to fight the world and show it his intrinsic mental power which must transcend all social restraints, his eyes fall on some uncovered strata in a quarry and he is profoundly humbled:

Escaping from the influences of personality, his imagination wrought back through eras of geologic time, held him in a vision of the infinitely remote, shrivelled into significance all but the one fact of inconceivable duration.¹¹

And again towards the end of the novel, when he reaches a similar resolution, he is overcome by a feeling of insignificance, which at this point assumes the dimensions of a general comment on the condition of life. He goes geologizing and

sitting down before some interesting strata, I lost myself in something like nirvana, grew so subject to the idea of vastness in geological time that all human desires and purposes shrivelled to ridiculous unimportance.¹²

A passage in Thomas Hardy's *A Pair of Blue Eyes* (1873) renders the same idea of man's smallness. When at a moment of crisis Henry Knight, slipping down a wet incline towards the cliff's edge, is faced with imminent death, his eye falls on a fossil trilobite embedded in the rock. Knight, Hardy specifies at this point, "was a fair geologist" and "at this dreadful juncture his mind found time to take

⁸ *Born in Exile*, p.228.

⁹ *Born in Exile*, p.227.

¹⁰ *Born in Exile*, pp.224,225.

¹¹ *Born in Exile*, p.61.

¹² *Born in Exile*, p.450.

in, by a momentary sweep, the varied scenes that had had their day between this creature's epoch and his own [and] time closed up like a fan before him. He saw himself at one extremity of years, face to face with the beginning and all the intermediate centuries simultaneously." Knight's reaction is similar to Peak's: "The immense lapses of time each formation represented had known nothing of the dignity of man."¹³ Hardy compares it to the numbing feeling of astronomy: "there is nothing to moderate the blow with which the infinitely great [...] strikes down upon the infinitely little, the mind of the beholder."¹⁴

Gissing emphasizes a spiritual emptiness, something irretrievably lost in Peak's materialistic generation. He offers no solutions; nature cannot be reconciled with true religious feeling any longer, natural theology is utterly unable to convince or to sustain faith. The novel is clearly part of a pessimistic and deterministic strain of writing of the end of the century which was shared by Hardy and Butler. Belief in the purely individualistic power of man in *Born in Exile* is ultimately defeated in Peak's untimely death, and modern religion itself scarcely survives in the materialistic and spiritless Broad Churchism of the Rev. Bruno Chilvers—who is not unlike Peak. Geology to Butler and Gissing has contributed to removing God from life and hope.

The humanizing power of geology

In the novels of William Hale White (Mark Rutherford) the characters' search for the personality of the divine author and man's place in the creation leads to a different contemplation on the contribution of science. Although written after Darwin's momentous book, White's stories are set before 1859 and his characters react to the discoveries in geology rather than in biology. In *The Revolution in Tanner's Lane* (1887) he explains that

we all of us have too vast a conception of the duty which providence has imposed upon us; and one great service which modern geology and astronomy have rendered is the abatement of the fever by which earnest people are so often consumed.¹⁵

The hobbyist dabbling in geology "as a relief and an occupation"¹⁶ discovered that the geological evidence of mass extinction was difficult to reconcile with a Christian belief in the eternity of the body. Without body, memory and immortality are unthinkable to White. In *The Autobiography of Mark Rutherford* (1881) he writes that

the greatest difficulty was the inability to believe that the Almighty intended to

¹³ *A Pair of Blue Eyes*, ch.22, p.240.

¹⁴ *Two on a Tower* (1882), ch.8, p.87.

¹⁵ *The Revolution in Tanner's Lane*, p.292.

¹⁶ "A Mysterious Portrait", in *The Autobiography of Mark Rutherford*, p.319.

preserve all the mass of human beings, all the countless millions of barbaric half-bestial forms which, since the appearance of man, had wandered upon the earth, savage or civilised. Is it like Nature's way to be so careful about individuals, and is it to be supposed that, having produced, millions of years ago, a creature scarcely nobler than the animals he tore with his fingers, she should take pains to maintain him in existence for evermore? The law of the universe everywhere is rather the perpetual rise from the lower to the higher; an immortality of aspiration after more perfect types; a suppression and happy forgetfulness of its comparative failures.¹⁷

The cause of disbelief springs from a universe governed by immutable laws which are far from the idea of a personal God and in these laws it is impossible to discern "any ultimate tendency."¹⁸ However, the utter smallness of man when seen against the immensity of geological time has a liberating effect on White.¹⁹ Geology has made clear that "man has not become of less importance, but it is seen that all things do not converge to him."²⁰ It made a kind of stoic resignation possible in the "bitterness of religion" which the orthodoxy of Rutherford's Independents and Unitarians denied.

George Eliot's vision of man's smallness against a geological background is similar to White's. Although she did not use geological interpretation as much as she was to use the implications of evolution in her fiction, she had read with interest contemporary books on geology. In a letter to a friend she writes that she has "read Buckland's *Treatise on Geology* with much pleasure, and I believe Lyell's is good though it differs in Theory."²¹ This experience she transferred to her novel *The Mill on the Floss* where she has Stephen Guest recommending Buckland's *Geology and Mineralogy* to Maggie Tulliver: "Stephen became quite brilliant in an account of Buckland's *Treatise*, which he had just been reading. He was rewarded by seeing Maggie let her work fall and gradually get so absorbed in his wonderful geological story that she sat looking at him."²²

The Floss is introduced in the novel as "the great river [which] flows for ever onward and links the small pulse of the old English town with beatings of the world's mighty heart."²³ It links the provincial St. Ogg to the rest of the world, its people to their past. The flood in the novel, the arbitrariness of which has often been remarked upon, is linked to Eliot's geological reading. When Maggie listens to Buckland's wonderful stories, although this is not explicit

¹⁷ *Autobiography*, p. 76.

¹⁸ *Autobiography*, p. 84.

¹⁹ Compare: "I had not come to reflect that, taking into account her [nature's] eternities, and absolute exhaustlessness, it was folly in me to fret and fume, and I therefore clung to the hope that I might employ myself in some way which, however feebly, would help mankind a little to the realisation of an ideal" (*Autobiography*, p. 111).

²⁰ "Notes on the Book of Job," in *Autobiography*, p. 300.

²¹ Letter to Martha Jackson, March 4, 1841, *The George Eliot Letters*, viii. 8.

²² *The Mill on the Floss*, p. 489.

²³ *The Mill on the Floss*, p. 363.

in the narration, she also listens to the geological objections against Moses's universal flood: the importance of the *Treatise* lay in the recantation of the leading advocate of it in the geological field. The veracity of the Noachian deluge is seriously damaged and with it God's repentance after it. Instead, floods become part of the economy of Nature to which man is regularly subjected. Its flooding in the past—"that awful visitation of God which her father used to talk of—which had made the nightmare of her childish dreams"²⁴—is introduced at the beginning of the novel and comes full circle with the final flood in which Maggie and Tom are drowned.

Eliot's humanism is not based on providence but on a mutual sympathy between human beings. Although "their lives have no discernable echo beyond the neighbourhood where they dwelt, [...] I find a source of delicious sympathy in these faithful pictures of a monotonous homely existence, which has been the fate of so many more among my fellow-mortals than a life of pomp or of absolute indigence, of tragic suffering or of world-stirring actions."²⁵ Expressions like these both reflect on and react to the new discoveries of the earth's age: man is an insignificant link which nevertheless contributes to the continuance of the chain of being. They preannounce the frequent use of the web-metaphor in *Middlemarch*: "Men's lives are as thoroughly blended with each other as the air they breathe."²⁶ Humanity has taken God's place in a world where the latter becomes increasingly absent: in *Adam Bede* it is not God but Dinah who leads to salvation.

The Outcast by Winwood Reade (1875) is an outspoken presentation of the good geological time had done to religion and humanity. The novel, set in the 1850s, is a series of letters written by Edward Mordaunt first to his son-in-law and then to his daughter. It is more or less presented as an autobiography although the author starts with the desperate case of Arthur Elliott, which is no more than a prelude to his own loss of orthodox faith; we read that "the works of Malthus and Darwin, bound in sombre covers, were placed on a table in his [Arthur Elliott's] room; the first was lettered outside, *The Book of Doubt*, and the second, *The Book of Despair*."²⁷ When, in his dreams, he looks at the earth as God, "the pleasure I derived at first from looking at the Earth was soon marred by the fearful tragedies which I saw everywhere enacted. It was nearly all blood and tears" and in his despair he concludes "that this earth-life of ours is only a satirical play."²⁸ He hangs himself.

Mordaunt becomes a clergyman and gets a small living at Stilbroke. He dreams of marrying Margaret and sees "her seated by my side after the labours

²⁴ *The Mill on the Floss*, p.651.

²⁵ *Adam Bede*, pp.207,173.

²⁶ *Adam Bede*, p.407.

²⁷ *The Outcast*, p.5.

²⁸ *The Outcast*, pp.26-7.

of the day, and rosy-cheeked children clambered on my knees. And the love of my children unborn filled my heart, and I revelled in anticipated joys;"²⁹ it is immediately after this that he receives a copy of Lyell's *Principles of Geology*. Mordaunt starts reading because "in fact, I had intended to order from London the latest works upon geology, as I considered it my duty to study the enemy's arguments in order to be able to refute them." Reade's analysis of Edward Mordaunt's reaction to Lyell's book is one of the fullest accounts of a contemporary non-geologist we have in English literature:

I began to read the "Principles" at once, and was soon captivated by the beauty of the style, the modesty of the author, and the wondrous world he opened to my view. There was not an allusion to theology in the book, which I read all through like a novel, with no sensation but that of enjoyment.

But contemplating the consequences of Lyell's theory, the duration of time and the absence of catastrophes seriously troubled him. He starts rereading *Principles*, "now well on my guard, and in a hostile attitude of mind. But I could discern no flaw in the reasoning, and could only venture to hope that the facts were not to be relied on." To decide the question he next picks up an orthodox work with a Mosaic account of the creation: "It was most ingenious—a perfect specimen of special pleading—but nevertheless could only deceive those who wished to be deceived." Another pious writer insisted in a pamphlet that the Bible was not intended to teach us geology, but "for me it was enough that there was one mistake in the Bible; that proved it could not have been written by God."³⁰ The seeds of doubt had been sown and resulted in a tortured conscience. Mordaunt could not continue as a coward in his role of minister of the Church without telling the truth about his real opinions.

The ordeal of geological evidence on the clergyman is represented as almost universal: to solve the enormous dilemma before which he had been placed by geology, Mordaunt decided to ask the opinion of a fellow clergyman, a Mr Watson, rector of a neighbouring village, who has had similar feelings on the subject ("Let us not speak of this again... It is a painful subject for me")³¹ and the bishop too admitted his own doubts when he was young: "[he] told me how he himself, when at my age, had also passed through a period of sceptical gloom, and had all but given up his profession."³²

Mordaunt leaves the cloth, however, and takes up the study of the sciences. When Margaret dies after a period of poverty and misery in London, Edward bursts out in fury against the God who had murdered her. Coming to himself again he finds, like Tennyson in *In Memoriam*, a purpose in living for Margaret's small daughter and his doubt resolves itself in a humanistic

²⁹ *The Outcast*, p.99.

³⁰ *The Outcast*, pp.103,102-4.

³¹ *The Outcast*, p.116.

³² *The Outcast*, p.130.

materialism which denies the personal relationship of God with the earth, in which "in common with the atoms of water and air, we are part of the material with which the Creator, through secondary laws, carries out his scheme."³³ In this he finds a link with his fellow human beings with whom he has to fight evil with charity. With this new religion he is able to look on the earth in a new and liberating way: "Hitherto I had looked on the Earth as a strange country, and life as the journey of a traveller. But now the Earth became my fatherland, and all mankind my fellow-countrymen."³⁴ Such a humanist vision of life and religion links him to William Hale White and George Eliot. Unlike Elliott, Mordaunt finds peace and happiness in his doubt. The extraordinary conclusion Mordaunt reaches is that "doubt dissipates superstition, and softens the rancour of religious life. Without doubt there can be no tolerance, and the history of tolerance is the history of doubt."³⁵

Thus, to William Hale White, George Eliot and Winwood Reade geology is not the scarecrow it was to pre-Darwinian protectors of the Mosaic account; on the contrary, to them it had had a benevolent influence on men's ideas of his place in the creation which led to a more humanistic vision of man's existence on earth.

³³ *The Outcast*, p.244.

³⁴ *The Outcast*, p.250.

³⁵ *The Outcast*, pp.254-55.

CONCLUSION

One of the driving forces behind Victorian society and its achievements was no doubt religion. Whether it was in the arts, legislation or science, all seemed to be based on divine law and the conviction that providence manifested itself in no other country so well as in Britain. Natural philosophy lent itself perfectly to the contemplation and admiration of the perfection of God's plan of creation, and geology in particular seemed appropriate to illuminate and confirm the history of the earth as recounted in the Pentateuch. It became the hobbyhorse of many a clergyman. Although professional geologists increasingly contested the restraint religion put on pure inductive science and the debate as to the validity of the Mosaic interpretation of the facts of nature became savage at times, the notion of natural theology kept religion and geology firmly together.

All this changed with the publication of *The Origin of Species* in 1859. Although its contents were mainly scientific it became "the sign of a movement bigger than Darwin, bigger than intellectual enquiry;"¹ the book firmly shook the confident outlook of Victorian society by questioning the place of man in the plan of nature. It also changed the way people looked at geology. If from the beginning of the century the science was much seen as the handmaid of religion from which it tried to break away, the advent of evolutionism very much made it the handmaid of Darwin's theory of earth history. Darwin's use of Lyell's principles in geological reasoning associated the two names in the public mind.

Buckland's early death in 1856 unfortunately made it impossible for him to react to evolution, but Lyell, Sedgwick and Whewell all participated in the post-Darwinian debate. What they shared in their reactions was their fear for the dignity of man and with it a loss of the moral values of Victorian society. They were reluctant to give up the urge that led them to the pursuit of science: natural theology.

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In the light of the views of geology and religious sentiment that the present study has discussed, it seems legitimate to conclude with the way Thomas Henry Huxley presented the relationship between science and religion to his readers. His views already testify to a later simplistic historiography of the pre-

¹ Chadwick, *The Victorian Church*, i.2.

Darwinian debate. Huxley wrote in 1890 as follows of the Mosaic controversy in geology:

At the present time, it is difficult to persuade serious scientific inquirers to occupy themselves, in any way, with the Noachian Deluge. They look at you with a smile and a shrug, and say they have more important matters to attend to than mere antiquarianism. But it was not so in my youth. At that time, geologists and biologists could hardly follow to the end any path of inquiry without finding the way blocked by Noah and his ark, or by the first chapter of Genesis; and it was a serious matter, in this country at any rate, for a man to be suspected of doubting the literal truth of the Diluvial or any other Pentateuchal history.

Huxley continues the passage with Lyell's achievement in the controversy:

The fiftieth anniversary of the foundation of the Geological Club (in 1824) was, if I remember rightly, the last occasion on which the late Sir Charles Lyell spoke to even so small a public as the members of that body. Our Veteran leader lighted up once more; and, referring to the difficulties which beset his early efforts to create a rational science of geology, spoke, with his wonted clearness and vigour, of the social ostracism which pursued him after the publication of the 'Principles of Geology,' in 1830, on account of the obvious tendency of that noble work to discredit the Pentateuchal accounts of the Creation and the Deluge.²

By the time Huxley wrote this, he was a lonely figure. A younger generation of scientists had sprung up, while the older generation, which had lived through the stormy years around 1859, had passed away. Whewell had died in 1866, Sedgwick in 1873, Lyell in 1875, and Darwin in 1882. It seems that, as the last survivor of these scientific supermen, he had the last word. His writing, in fact, is in a number of ways characteristic of later views of the role of Lyell and the other geologists in the years before the publication of *The Origin of Species*.

First, the reader gets the impression that geology is mainly seen as the handmaid of evolution in reducing the account of creation in the Pentateuch to mere legend, and Lyell's achievement is harnessed in the service of Huxley's battle against bibliolatry in science. The passage in which Huxley describes Lyell's last address to the Geological Society of London depicts the geologist mainly as a crusader against Moses, a role in which Lyell no doubt saw himself. Huxley's atheistic writing however obscures the fact that Lyell's efforts to free the science from Moses had no repercussions on his religious sentiments. It ignores Lyell's caution in matters touching on religion as illustrated by his reaction to the writings of George Hoggart Toulmin, which he considered offensive to the religious sentiments of the age. These feelings he repeated to Huxley in 1866 about a course of lectures on the antiquity of man. Huxley, who, in his defence of evolution, gained himself the name "Darwin's Bulldog",

² "Lights of the Church and Science," *Science and Hebrew Tradition*, pp. 215-16.

often seems to dismiss the clergy as scientific simpletons and rather sarcastically belittles the biblical scholars:

If we are to listen to many expositors of no mean authority, we must believe that what seems so clearly defined in Genesis—as if very great pains had been taken that there should be no possibility of mistake—is not the meaning of the text at all. The account is divided into periods that we may make just as long or short as convenience requires. We are also to understand that it is consistent with the original text to believe that the most complex plants and animals may have been evolved by natural processes, lasting for millions of years, out of structureless rudiments. A person who is not a Hebrew scholar can only stand aside and admire the marvellous flexibility of a language which admits of such diverse interpretations.³

Although Huxley's exasperation with recent attempts at Mosaic geology—notably Prime Minister William Ewart Gladstone's⁴—might justify such a comment, this is not the kind of writing Lyell would have approved of.

Secondly, Huxley's presentation seems to give Lyell the credit of creating the science of geology, while he ignores the work of Buckland, Sedgwick or many a member of the Geological Society, who, because of their clerical positions, struggled more than Lyell against dogmatic Mosaicists: "Geological science has become what it is, chiefly because geologists have gradually accepted Lyell's doctrine and followed his precepts."⁵

Finally, in the essays Huxley published in 1893, he seems to revel in the victory of evolution over religion and classes Lyell with Darwin and the evolutionists. Apart from his scientific reservations, it remains highly improbable that Lyell the man could ever convince himself of the validity of Darwin's theory as an explanation of the perfection of man's spiritual and moral being. One might wonder what Lyell would have thought of Huxley posthumously becoming *his* "Bulldog" as well.

Huxley's science, unfortunately, looks rather stark beside the doubts which beset an earlier generation of naturalists. It lacks the alternative of a more humanistic vision of man, as we find it, for example, in non-scientists like William Hale White, Winwood Reade or George Eliot. In Lyell's own words: "the descent of man from the brutes [...] takes away much of the charm from my speculations on the past relating to such matters."⁶ Such a sentiment would have been shared by Buckland, Sedgwick and Whewell. Evolution—with its leading principle of natural selection—took away their much cherished premises of natural theology.

³ "Lectures on Evolution," *Science and Hebrew Tradition*, p.64.

⁴ "Dawn of Creation and Worship: A Reply to Dr. Réville", *Nineteenth Century*, 18 (1885) 685-706.

⁵ "Science and Pseudo-Science," *Science and Christian Tradition*, p.100.

⁶ Letter to Darwin, March 11, 1863, *LLL* ii.363.

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